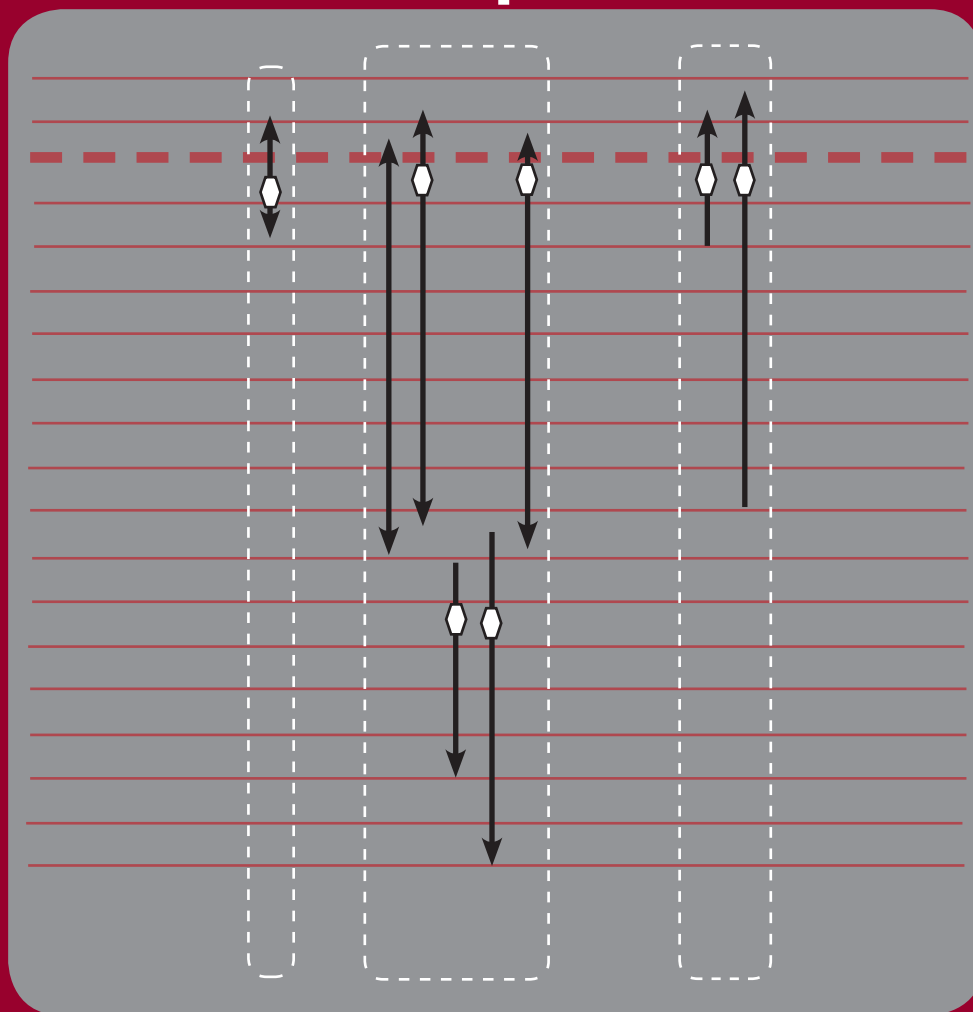




# Modeling Patient-Centered Medical Home Principles, Attributes, and Patient Experiences: Technical Report



Agency for Healthcare Research and Quality  
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HEALTH IT



# **Modeling Patient-Centered Medical Home Principles, Attributes, and Patient Experiences: Technical Report**

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**Health IT**

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- Project team members Jason Mitchell and Holli Thornton from the American Academy of Family Physicians, and Lura Kolkman and Barbara Bateman from Mosaica Partners,.
- The expert panel members and provider workgroup.

# Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>Background .....</b>	<b>1</b>
<b>Purpose.....</b>	<b>1</b>
<b>Methodology .....</b>	<b>1</b>
<b>Components of the Framework .....</b>	<b>2</b>
<b>Implications .....</b>	<b>3</b>
<b>Gaps and Further Work.....</b>	<b>3</b>
 <b>Patient-Centered Medical Home (PCMH) Information Framework</b>	
<b>Technical Report.....</b>	<b>4</b>
<b>Introduction.....</b>	<b>4</b>
<b>Background .....</b>	<b>4</b>
<b>Project Overview.....</b>	<b>5</b>
<b>Project Team .....</b>	<b>5</b>
<b>Expert Advisory Panel.....</b>	<b>5</b>
<b>Purpose of Project.....</b>	<b>6</b>
<b>Current Definitions of the Patient-Centered Medical Home.....</b>	<b>7</b>
<b>Working Definition of the Patient-Centered Medical Home .....</b>	<b>8</b>
<b>Methodology .....</b>	<b>8</b>
<b>Literature Review .....</b>	<b>8</b>
<b>Development of a PCMH Information Framework .....</b>	<b>9</b>
<b>PCMH Information Framework Development: Definition of the Domain .....</b>	<b>11</b>
<b>The PCMH Information Framework.....</b>	<b>11</b>
<b>Validation Process for PCMH Information Framework and Model.....</b>	<b>15</b>
<b>A First Information Model for the PCMH.....</b>	<b>16</b>
<b>Interactions Focused on PCMH and Patient.....</b>	<b>16</b>
<b>Interactions Focused on PCMH and Subspecialty Clinic .....</b>	<b>27</b>
<b>Interactions Focused on PCMH and Inpatient Care.....</b>	<b>36</b>

## Contents (continued)

Mapping of PCMH Attributes to Health IT Use Cases.....	47
IS 01 – EHR Laboratory Results Reporting.....	48
IS 02 – Biosurveillance.....	49
IS 03 – Consumer Empowerment and Access to Clinical Information via Networks .....	49
IS 04 – Emergency Responder EHR .....	50
IS 05 – Consumer Empowerment and Access to Clinical Information via Media .....	51
IS 06 – Quality .....	52
IS 07 – Medication Management .....	52
IS 08 – Personalized Health Care .....	53
IS 09 – Consultations and Transfers of Care .....	54
IS 10 – Immunizations and Response Management .....	54
IS 11 – Public Health Case Reporting .....	55
IS 12 – Patient-Provider Secure Messaging.....	56
IS 77 – Remote Monitoring .....	56
IS 91 – Maternal and Child Health .....	57
IS 92 – Newborn Screening .....	58
IS 98 – Medical Home.....	59
IS 107 – EHR-Centric.....	59
IS 158 – Clinical Research.....	61
Key Attributes not Covered in Any Interoperability Specification .....	61
Conclusions From Mapping.....	63
Implications .....	63
For Patients.....	63
For Providers.....	63
For Health IT Vendors .....	64
For Policymakers .....	64
Future Work.....	64
Current Gaps.....	64
Alternative Interaction and Process Maps .....	65
Validation and Dissemination .....	65
References .....	66

## Contents (continued)

### Figures

Figure 1. Overview of the PCMH Information Framework .....	9
Figure 2. Information Model Framework Methodology .....	10
Figure 3. Patient Health Information Lifecycle .....	12
Figure 4. Patient Line of Vision .....	13
Figure 5. The Canvas .....	14
Figure 6. Scenario 1 Interaction Diagram .....	18
Figure 7. Scenario 2 Interaction Diagram (Part 1) .....	20
Figure 8. Scenario 2 Interaction Diagram (Part 2) .....	21
Figure 9. Scenario 3 Interaction Diagram .....	25
Figure 10. Scenario 4 Interaction Diagram .....	28
Figure 11. Scenario 5 Interaction Diagram .....	31
Figure 12. Scenario 6 Interaction Diagram .....	34
Figure 13. Scenario 7 Interaction Diagram .....	37
Figure 14. Scenario 8 Interaction Diagram .....	40
Figure 15. Scenario 9 Interaction Diagram (Part 1) .....	44
Figure 16. Scenario 9 Interaction Diagram (Part 2) .....	45

### Table

Table 1. Expert advisory panel members .....	6
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### Appendixes

Appendix A: List of PCMH Principles and Attributes .....	68
Appendix B: PCMH Attributes X Scenario Matrix.....	70
Appendix C: PCMH Attributes X Interoperability Specification Matrix.....	75

# Executive Summary

## Background

There are multiple definitions and descriptions of a patient-centered medical home (PCMH). Some of these descriptions consist of sets of principles associated with the concept of PCMH. However, the evolution of the PCMH concept has not yet led to a clear understanding of how its core principles relate to the actual experiences of patients and providers within a PCMH. Similarly, health IT vendors have faced difficulties in defining the process flows and specific functionalities that are needed to support the PCMH.<sup>1</sup> These limitations point to the need for a tool to support the process of linking core principles to clinical activities and health IT capabilities. Such a tool should lead to the development of a functional definition of the PCMH that would resonate with consumers, providers, policymakers, and health IT vendors. Because patient and provider interactions form the core of the PCMH concept, this tool needs to provide details explaining the capabilities and information flows of the PCMH. An information framework can be such a tool. It can organize concepts, relationships, and information flows into a structure that can be documented and shared.<sup>2</sup>

## Purpose

A review of the literature on the PCMH showed a lack of an existing information framework or model. Existing health IT information models focused more on the data requirements than on modeling the interactions and capabilities of the interdisciplinary care team that forms the core of the PCMH. The authors undertook a process to develop a framework to construct an information model that would (1) describe the capabilities of the PCMH, (2) represent the information flows among different participants in the PCMH, (3) account for the flexibility in how the PCMH is implemented, and (4) allow for changes as the PCMH continues to mature and evolve.

## Methodology

The literature review on topics related to the PCMH, patient-centered care, continuity of care, and patient experience provided a list of core principles of a PCMH, as well as a long list of attributes describing the PCMH. These lists were used as foundation material for developing the framework.

An expert advisory panel representing key stakeholders provided feedback and guidance on finalizing the list of principles and pairing attributes with specific principles. The panel emphasized the need to maintain flexibility within the framework to accommodate future evolution and changes within the PCMH. The panel later provided feedback on the complete framework, its presentation, and efforts to disseminate it to groups of stakeholders.

The principles and attributes were used in creating illustrative patient experience scenarios that could be used to model the framework. These scenarios were reviewed and analyzed to identify discrete interactions between various actors (patient and clinic personnel) across sites and subsites (locations where the interactions took place). These discrete interactions were



illustrated graphically in the form of interaction diagrams. These interaction diagrams could be used to describe in detail the process flows, which in turn could help identify specific data elements that are needed to develop health information technology (HIT) systems. Any discussion or development of the last two aspects (process flow and data elements) was outside the scope of this project.

## **Components of the Framework**

The primary components of this framework are PCMH principles, PCMH attributes, and patient scenarios. The core principles were identified from the literature as follows:

- Access
- Coordinated care
- Continuity of care
- Community linkages
- Information system support
- Payment
- Patient-centered care
- Provider type
- Quality
- Scope of care
- Active care management
- Other

Each of these principles has a set of attributes that describes how the principle may be identified or operationalized. Appendix A provides the list of the attributes associated with each of these principles.

This report includes nine fictitious patient scenarios that provide examples of modeling using this framework. The scenarios illustrate experiences within a PCMH and describe the PCMH attributes in action. Detailed analysis of those experiences is conducted to identify discrete interactions and flow of information across different sites, subsites, and actors involved, and to create the interaction diagrams.

Although the patient scenarios may be of interest primarily to patients and clinicians, health IT vendors may find the mapping of Health Information Technology Standards Panel (HITSP)'s

Interoperability Specifications (IS) with the PCMH attributes particularly beneficial in examining the current standards in the context of the PCMH principles and attributes.

## **Implications**

Patients, clinicians, policymakers, and anyone else with an interest in PCMH may use this framework to gain a better understanding of what the principles found in the literature mean in terms of specific attributes and real-life experiences of patients within a PCMH. The framework also provides an approach to examine the details of interactions and flow of information within and outside the PCMH. Further work in developing these information flows into process flows and data elements would help health IT vendors in examining the current standards and ensuring that guidelines for system development match the PCMH attributes. Although further work is necessary to clarify the definitions of the principles and attributes, and the association of attributes with specific principles, this framework provides an approach in identifying the current attributes of one's own PCMH and the potential for change.

## **Gaps and Further Work**

This framework needs to be validated by structured engagement of various stakeholder groups in examining the framework and applying it to real-life situations, to test if the approach works in a variety of situations and to study the range of outcomes when this approach is applied.

The principles and associated attributes need to be further defined and clarified, with the goal of achieving standardization that would support universal understanding and interpretation. In particular, the matching of attributes to the principles needs to be examined and tested further. Classification of the attributes into essential and non-essential categories would help in prioritizing the attributes for future work aimed at developing this model.

More work is needed to develop additional illustrative scenarios that would address unique combinations of attributes and patient characteristics and experiences. Further validation of these scenarios as examples of modeling of patient care using our framework also is warranted. The interaction diagrams are one way to graphically illustrate the flow of information across actors, sites, and subsites. Other ways of graphically illustrating information flow may be explored for specific purposes in applying this framework.

The mapping of the attributes with the HITSP interoperability specifications will need to be reexamined once the definitions of principles and attributes are further refined. Moreover, additional specifications developed by HITSP can be mapped with the PCMH attributes to review the extent to which they address PCMH elements.

# Patient-Centered Medical Home (PCMH) Information Framework Technical Report

## Introduction

This report describes the framework for a patient-centered medical home (PCMH) that brings together the principles associated with a PCMH, the attributes associated with each of those principles, and illustrative patient scenarios that can be used to describe how the attributes may be fulfilled within a PCMH. The scenarios are analyzed to identify discrete interactions between actors across sites and subsites. These discrete interactions are then graphically illustrated in the form of interaction diagrams, which can be used to develop process flows and specific data elements for health information technology (HIT) systems. The Health Information Technology Standards Panel (HITSP)'s Interoperability Specifications (IS) have been mapped to the PCMH attributes identified in this framework.

The purpose of this framework is to develop a better and broader understanding of how well-known PCMH principles may be translated into attributes, actions, and flow of information within and outside a PCMH. This report provides the complete details on the origin of the project, the project team, the methodology for developing the framework, the specific components of the framework, the nine illustrative patient scenarios, and mapping of the PCMH attributes to the interoperability specifications. For a shorter version of the report focusing mainly on the principles, attributes, and patient scenarios, please see the report on “Modeling Patient-Centered Medical Home (PCMH) Principles, Attributes, and Patient Experiences.”

## Background

As health care costs continue to accelerate and the overall level of quality of care remains unsatisfactory, the PCMH offers a promising model of care delivery. The PCMH concept has its origins in the 1960's but until now the environment, including health information technology, was unable to fully support it. The American Academy of Pediatrics (AAP) in 1967 introduced the term “medical home” in the context of caring for children with special needs.<sup>3</sup> A key issue at that time was the need for a central location for the patient's health information. The PCMH concept has continued to evolve over the past four decades. In 2002, the AAP expanded the concept to include many additional attributes.<sup>4</sup> Independently, the American Academy of Family Physicians (AAFP) in 2004 defined a “new model of care” as part of the Future of Family Medicine Project.<sup>5</sup> The AAFP's model included an emphasis on health information technology and had core attributes that overlapped with those of the AAP's medical home concept. Following the AAFP's recognition that its new model shared many attributes with the medical home, the term “patient-centered medical home” gained currency. In 2007, the main professional societies for primary care (the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Physicians, and the American Osteopathic Association) established a set of joint principles for the PCMH, and the model has received widespread endorsement in the larger health care community.<sup>6</sup>

The evolution of the PCMH concept has not yet led to a clear understanding of how its core principles relate to the actual experiences of patients and providers within a PCMH. Similarly, health IT vendors have faced difficulties in defining the process flows and specific functionalities that are needed to support the PCMH.<sup>1</sup> These limitations point to the need for a tool to support the process of linking core principles to clinical activities and health IT capabilities. Such a tool should lead to the development of a functional definition of the PCMH that would resonate with consumers, providers, policymakers, and health IT vendors. Because patient and provider interactions form the core of the PCMH concept, this tool needs to provide details about the capabilities and information flows of the PCMH. An information framework and model can be such a tool. It can organize concepts, relationships, and information flows into a structure that can be documented and shared.<sup>7</sup>

A review of the literature on the PCMH showed a lack of an existing information framework or model. Existing health IT information models focused more on the data requirements than on modeling the interactions and capabilities of the interdisciplinary care team that forms the core of the PCMH. The authors undertook a process to develop a framework to construct an information model that would (1) describe the capabilities of the PCMH, (2) represent the information flows among different participants in the PCMH, (3) account for the flexibility in how the PCMH would be implemented, and (4) allow for changes as the PCMH continues to mature and evolve.

This report provides an overview of the development of a PCMH information framework, describes an initial set of scenarios and information flows, and provides mapping of PCMH attributes to Healthcare Information Technology Standards Panel (HITSP) specifications. A search of the literature suggests that this work has not been done before.

## **Project Overview**

### **Project Team**

The contract was awarded to Westat in partnership with American Academy of Family Physicians (AAFP) and Mosaica Partners, LLC. Daksha Arora, PhD, CPHIT of Westat was the project manager and Steven E. Waldren, MD, MS of the AAFP served as the principal investigator. Bob Brown of Mosaica Partners served as the primary consultant on the development of the information framework and information modeling tools, such as interaction diagrams.

This work also benefited from the input of providers and received guidance from an expert advisory panel that played an important role by keeping the project team apprised of ongoing work on the PCMH concept and reviewing the project team's interim work products.

### **Expert Advisory Panel**

To support the project team and expand the expertise focused on the project, an expert advisory panel was established. This panel had representatives from policymakers, health IT vendors, provider organizations, and patient advocacy organizations. The individuals making up the panel are listed in Table 1.

**Table 1. Expert advisory panel members**

<b>Name</b>	<b>Organization</b>	<b>Stakeholder group</b>
Melinda Abrams, M.S.	Commonwealth Fund	Patient
John Klien, MD	American Academy of Pediatrics	Provider
Carmella Bocchino	America's Health Insurance Plans	Health Plans
Christine Bechtel	National Partnership for Women and Families	Patient
Shawn Martin	American Osteopathic Association	Provider
Carol Diamond, MD	Markle Foundation	Policy
Paul Grundy, MD	IBM	Employer
Charles Kilo, MD	American College of Physicians	Provider
Terry McGeeney, MD	TransforMED	Provider
David Nace, MD	McKesson	Vendor
Bob Phillips, MD	AAFP	Provider
Rick Ratliff	Accenture	Vendor
Cris Ross	SureScripts	Provider/Policy
Chris VanWeel, MD	President, World Organization of Family Doctors	International/Provider

## Purpose of Project

The AHRQ task order had the stated purpose of seeking to advance the PCMH concept by supporting a broad understanding of the PCMH as a series of information flows among patients and other PCMH stakeholders. The authors set out to create a PCMH information framework to support the development of scenarios, information flows, and process flows to describe the PCMH. The framework can define the scope of the PCMH by listing principles and attributes or capabilities. These attributes are then linked to a set of scenarios and interaction diagrams that describe how the attribute is performed. From these interaction diagrams, process flows and data element requirements can be elucidated. These scenarios and interaction diagrams can be used to facilitate a broad understanding of the PCMH among patients, providers, and health IT vendors. A common information framework was needed to ensure consistency in that understanding, while allowing each audience to focus on a suitable level of detail. For example, the process flow within a PCMH may be of little interest to patients but will be crucial for the provider and health IT vendor audiences. Similarly, the health IT vendor audience may give little weight to narrative descriptions of a patient's experience, as such narratives do not provide enough specificity to design an IT system.

Current electronic health record systems do not fully support the PCMH.<sup>8</sup> In health IT systems development, use cases, which represent a constrained set of information flows, process flows, and data elements, are used to define the requirements for a specific system function. Another purpose of this project was to identify PCMH-related gaps in health information technology use cases from the Health Information Technology Standards Panel by mapping the use cases to the PCMH information framework developed under this initiative. Such a mapping would demonstrate the attributes of the PCMH that are lacking in national health IT use cases and may identify the need for further work.

## Current Definitions of the Patient-Centered Medical Home

In order to develop a working PCMH definition that would take into account this project's priorities, we identified popular definitions that could serve as reference points. The first was the AHRQ definition<sup>9</sup> summarized here:

*The medical home model holds promise as a way to improve health care in America by transforming how primary care is organized and delivered. Building on the work of a large and growing community, the Agency for Healthcare Research and Quality (AHRQ) defines a medical home not simply as a place but as a model of the organization of primary care that delivers the core functions of primary health care. The medical home encompasses five functions and attributes:*

- *Patient-centered*
- *Comprehensive care*
- *Coordinated care*
- *Superb access to care*
- *A systems-based approach to quality and safety*

A second definition consisted of the PCMH joint principles that were developed by the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Physicians, and the American Osteopathic Association. The joint principles describe these characteristics of the PCMH:

- Relationship with a personal physician
- Physician-directed practice
- Whole-person orientation
- Coordinated and/or integrated care
- Quality and safety
- Enhanced access
- Appropriate payment structure<sup>6</sup>

A third definition, the Institute for Healthcare Improvement (IHI) Triple Aim, tied the principle of payment change, which was not part of the AHRQ definition, with improvements in quality and cost efficiency. The three aims are to improve the health of the population, enhance the patient experience of care, and reduce the per capita cost of care.<sup>10</sup>

Finally, the literature<sup>11,12,13,14,15,16,17</sup> suggests additional attributes of the PCMH concept that have the potential to improve quality, including patient engagement, team-based care, continuity of information, population management, and a systematic approach to quality improvement.

## Working Definition of the Patient-Centered Medical Home

Creating a comprehensive set of scenarios and information flows that would cover every combination of attributes of a PCMH was beyond the scope and the capabilities of this project. Thus, we created a set of nine illustrative scenarios as examples of our approach. The working definition of the PCMH used for this project takes into account the definitions cited above, with a project-specific focus on patient experiences, clinical interaction and information flows, and the intended audiences (patients, providers, policymakers, and health IT vendors). For this project, the ***PCMH is an evolving, patient-centered, interconnected, health IT-enabled primary care delivery model that provides access to high-quality, coordinated, efficient, and satisfying care that promotes positive outcomes.*** The PCMH information framework was designed both to organize and prioritize the current work, and to support the entire PCMH concept as it continues to mature and evolve over time.

During the creation of the PCMH information framework, a comprehensive list of PCMH attributes was created from the literature (Appendix A). This attribute list allowed validation that the information framework would support the full PCMH, and provided a tool to demonstrate gaps in the current patient scenarios and other constructs such as health IT use cases.

This work also benefited from the input of providers and received guidance from the expert advisory panel (Table 1) that played an important role by keeping the project team apprised of ongoing work on the PCMH concept and reviewing the project team's interim work products.

## Methodology

### Literature Review

A literature review was conducted looking for articles discussing the PCMH, patient-centered care, continuity of care, and patient experience. Because of the lack of articles specific to the PCMH and information flows, a wider search was performed. A medical librarian using MEDLINE conducted the search and identified 5,832 potential articles. Review of the article titles, followed by review of the abstracts of articles that appeared to be relevant, yielded a list of 62 articles suitable for further review. Relevant articles from the gray literature<sup>9,11,12,13,14,15,16,17</sup> were added to the list. The search results provided the basis for defining the principles and the attributes for this work.



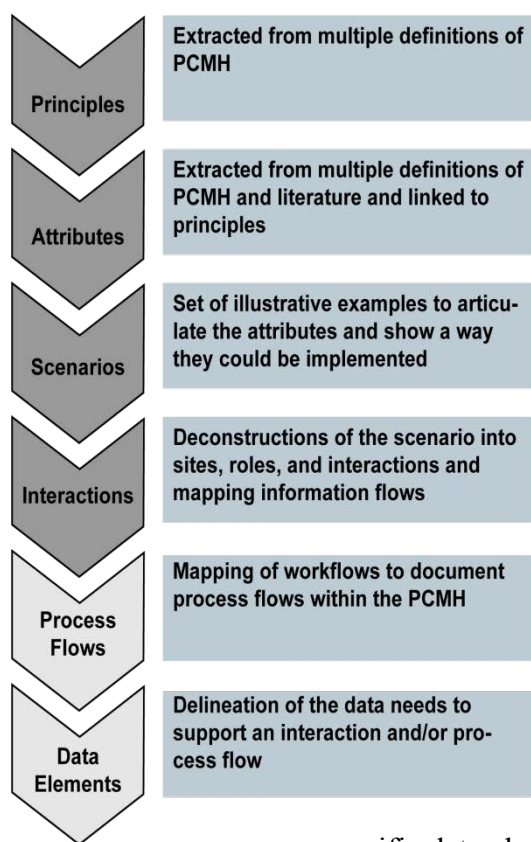
Throughout the literature on PCMH, there was consistency about the core principles: access to care, continuity of care, care coordination, patient-centered care, quality, use of information technology, and need for payment alignment. It was also found that similar terms were used to describe the attributes and capabilities that made up the principles. What was lacking were clear and unambiguous definitions of the attributes and capabilities.

An additional search for articles about information modeling in medicine did not identify an information model with a scope comparable to that of the PCMH. This demonstrated the need for a repeatable, scalable, and extensible framework to support the PCMH information framework to use in developing such a model.

## Development of a PCMH Information Framework

The PCMH is a potentially significant paradigm shift in health care delivery, but common understanding of the PCMH is limited to principles and high-level concepts. Our PCMH information framework (Figure 1) links these principles and concepts to a set of interactions and process flows, resulting in a richer definition of the PCMH that can be easily understood by PCMH stakeholders (patients, providers, policymakers, and health IT vendors).

**Figure 1. Overview of the PCMH Information Framework**



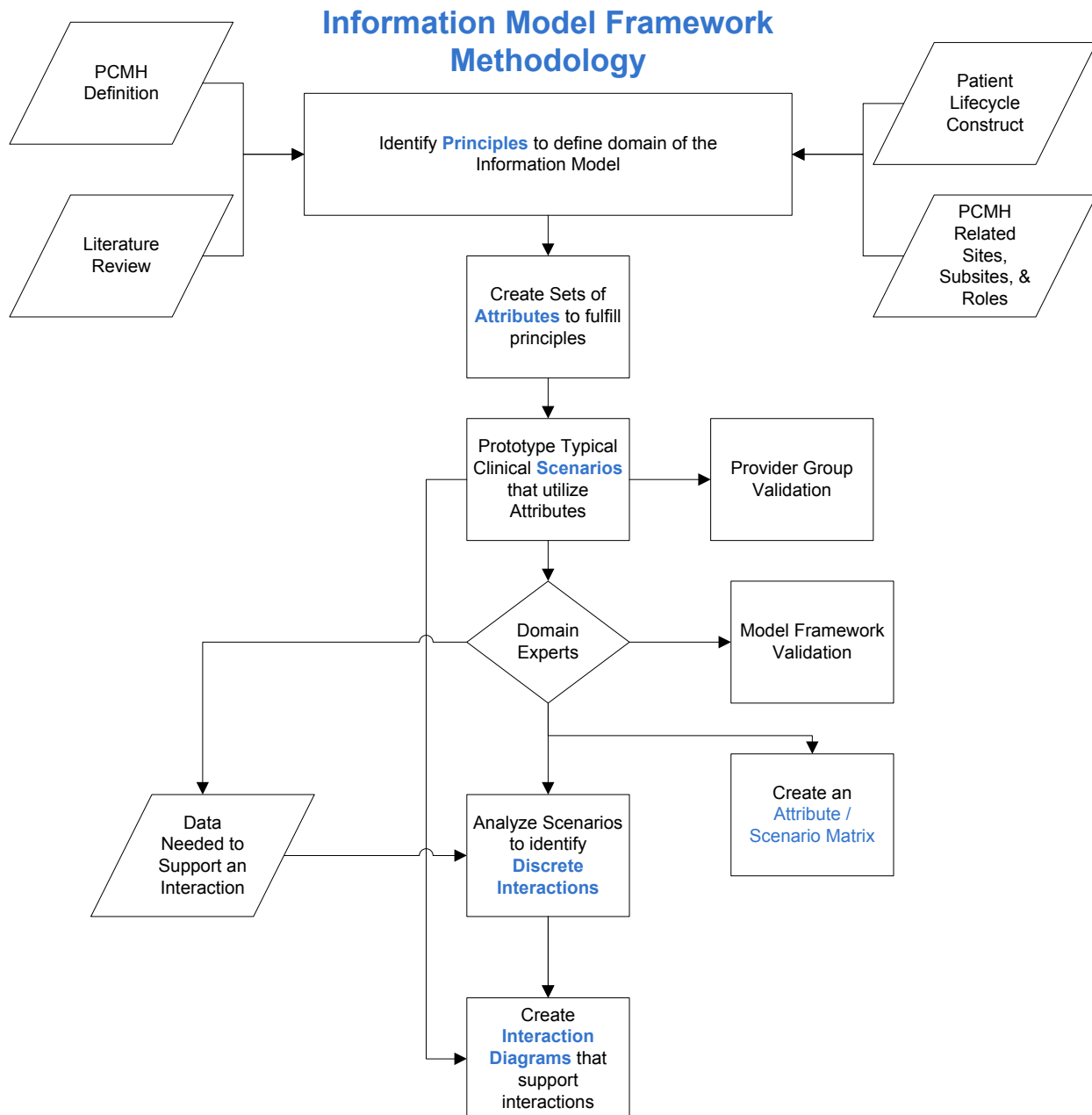
The framework starts with the *identification of principles* to define the domain (i.e., scope) of the PCMH information model. These are used to create a *set of attributes* that are needed to fulfill the principles. “Attribute” is used because the concept describes the principle, in terms either of what it is or how it is implemented. The sites, subsites, and roles within a PCMH are then defined to clarify the locations and actors. *Prototypical clinical scenarios* are created describing how sets of attributes may be fulfilled within certain sites, subsites, and roles played by different actors. *Domain experts* (in our project, the expert advisory panel and the provider workgroup) then review these scenarios. The scenarios are then broken down into the *discrete interactions* that comprise the scenario. From the discrete interactions, an interaction diagram is created to illustrate the flow of information within and outside the PCMH. These discrete interactions can also be used to create *process flow diagrams* to represent what the workflow may be to support the interactions. At this point,

specific data elements that are needed to support an interaction and develop system requirements could be identified. (See Figure 2). Process flow diagrams and data elements development were outside the scope of this effort.



As an information model drills down through attributes, interaction diagrams, and process flows, it becomes more specific, allowing for the development of information systems that can support the interactions and process flows. However, overspecification of information flow processes reduces implementation flexibility in achieving the attributes or principles. To maintain implementation flexibility of the model, the information framework supports the use of alternative interactions to support an attribute and multiple alternative process flows to implement an interaction.

**Figure 2. Information Model Framework Methodology**



## PCMH Information Framework Development: Definition of the Domain

The principles that define the domain (e.g., scope) of the information framework were derived from the definition of the PCMH (see section above) and literature review. In a literature review of the many definitions of the PCMH,<sup>18</sup> Vest et al. identified principles that are consistent with those found in our review of the literature. The following are the principles used in our PCMH information framework.

- Improved access to care
- Coordinated care
- Continuity of care
- Linkage to community resources
- Use of health information technology
- Patient-centered care
- Payment alignment
- High-quality care
- Appropriate scope of care
- Active care management

An extensive list of attributes describing a PCMH was found in the literature. We grouped the attributes under each principle as appropriate. Appendix A shows the list of attributes identified and grouped by their corresponding principles. An additional category of attributes relevant to provider type was found in both our work and in that of Vest et al. Three additional attributes were not related to a specific principle, but were listed in the definitions as important: regulatory compliance, financially responsible and successful practice, and optimized office design. The remaining attributes were mapped to one of the principles.

Although the literature identified many attributes of the PCMH, there was a lack of formal definitions for those attributes. This limits the ability to determine if an instance of the PCMH information model is complete. It also complicates the mapping of the PCMH to established health IT use cases.

## The PCMH Information Framework

In addition to the literature review and feedback from the expert panel, the PCMH Information Framework was assembled from components known to the authors from their prior work in the fields of medicine, medical informatics, and consulting services. These key

components provided the structured environment for development of the initial version of an PCMH information model.

The authors' use of specific information modeling and notation tools to construct the initial PCMH information model will allow it to be modified and updated as required. The proper use of the information modeling and notation tools within the framework results in standardized outputs. These outputs can be used to compare and contrast proposed changes to the PCMH information model and the processes used within the PCMH and its supporting ecosystem.

## Framework Constructs and Concepts

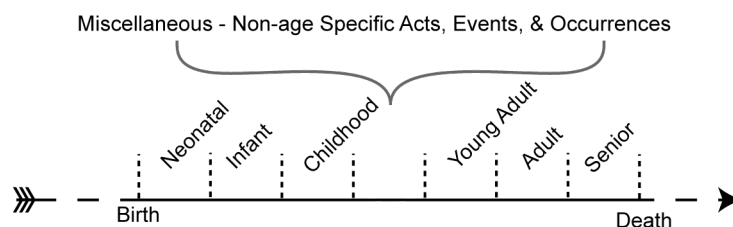
*Principles and Attributes.* Based on the concepts used in solutions-based consulting, the principles and attributes describe the general—and very specific—capabilities that typically are associated with a PCMH. The principles were identified based on the literature review, as discussed earlier in this document. An attribute can be thought of as a description of a capability that exists within a PCMH, or a service that is offered by a PCMH. For ease of use, the attributes are grouped by categories that generally correspond to the high-level principles that describe the PCMH. (See Appendix A) As additional capabilities become associated with the PCMH, the associated attributes list can be expanded.

*Scenarios.* The scenarios are short, fictitious narratives that illustrate what patients and providers may experience in the PCMH. Each scenario describes a patient's interactions with the PCMH and its extended ecosystem, and incorporates one or more attributes associated with the PCMH. The scenario describes how the capabilities associated with the attributes are used to facilitate the specific services being provided.

Scenarios, as used in the PCMH Information Framework, have additional uses. Scenarios can devolve into HIT use cases and, subsequently, into HIT test cases.

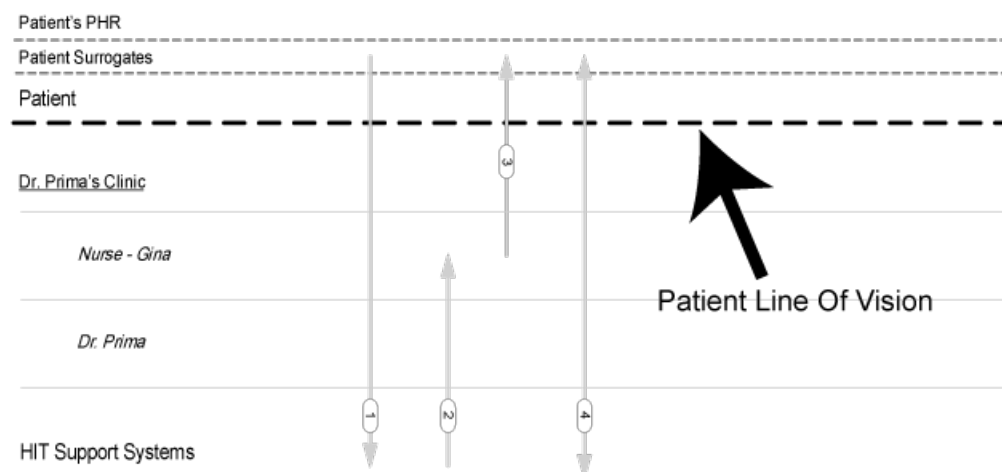
*Patient Health Information Lifecycle.* This construct, a variation of the “customer lifecycle” that is well known in the fields of customer value management (CVM) and customer experience management (CEM), uses eight stages to organize and categorize the acts, events, and occurrences that happen during a patient's lifetime (Figure 3). This construct is used to classify health-related issues and events that are unique to each stage of life, and the implications for a PCMH. A miscellaneous, non-age-specific category also is included to capture health events, such as accidents and injury, that are unrelated to any specific stage.

**Figure 3. Patient Health Information Lifecycle**



*Patient Line of Vision.* This construct, also well known to CVM and CEM practitioners, details what the patient can experience when dealing with the PCMH(Figure 4). The patient's line of vision indicates the boundary for everything that he or she can experience or is involved with directly. This construct is used in creating the interaction diagram, a graphic illustration of the discrete interactions within a scenario.

**Figure 4. Patient Line of Vision**



*Sites, Subsites, and Roles.* Based on our collective experience, we found the concept of “actors” (included in many use cases) to be too limiting and not conducive to documenting the specific informational needs or activities performed in the context of the PCMH ecosystem. Instead of actors, we used the constructs of site, subsite, and role. This allows the modeling of different information or process flows depending on the location of the role. For example, the information and process flows may be different if the patient educator role is within the PCMH practice or is contracted from an outside facility. Also, for example, the reference to primary care is used both for the site (the clinic) and the person (the clinician role). This distinction of site, subsite, and actor helps clarify such differences.

This classification also enabled a level of precision and granularity in writing a scenario or use case that previously was not possible. A common hierarchy of PCMH-related sites, subsites, and roles would support the documentation of PCMH scenarios and use cases in a format suitable for comparing and contrasting scenarios (or use cases), and for quickly spotting gaps.

## Information Modeling Tools

*Interaction Diagramming.* This technique involves deconstructing scenarios into a series of statements that describe individual interactions. Those interactions and the accompanying information flow(s) can then be graphically represented using lines and arrows. The diagrams are drawn on a stylized grid that we refer to as “the canvas.”(Figure 5)

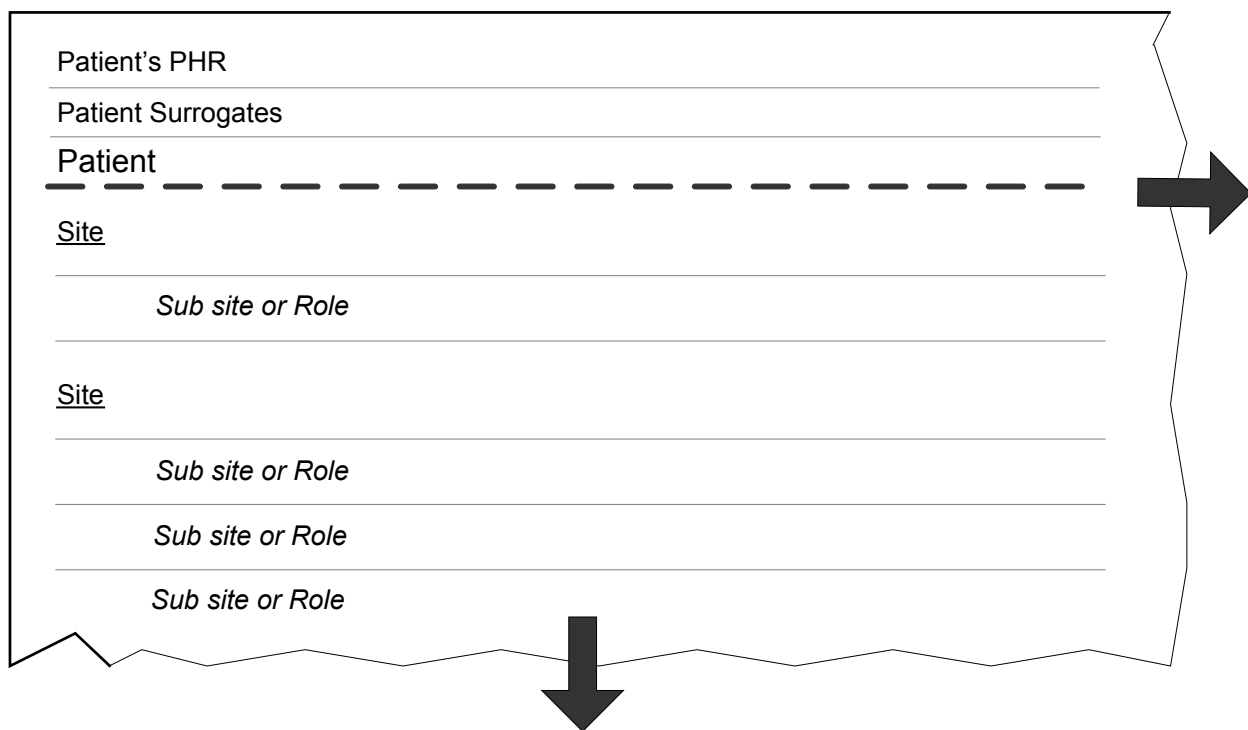
*Multifunctional Process Diagramming.* This technique uses “swim lane” process diagrams to represent functional areas (specifically sites, subsites, and roles) of the health care enterprise, and then documents the actions that take place within and between the functional areas. (Swim lanes are also referred to as functional layers or bands.)

The canvas is actually a stylized grid—extensible both horizontally (interactions) and vertically (functional layers)—that contains the following elements:

- Patient line of vision
- Patient, patient surrogate, and patient personal health record (PHR) bands (all above the patient line of vision)
- Bands representing the sites, subsites, and roles spelled out in the corresponding scenario (all below the patient line of vision)

As noted above, each canvas is customized to correspond to the sites, subsites, and roles present in a specific scenario.

**Figure 5. The Canvas**



## Resulting Outputs

*PCMH Attribute x Scenario Matrix* (Appendix B). This matrix illustrates which PCMH attributes are incorporated into specific scenarios. The matrix can be used to ensure that all attributes have been incorporated into at least one scenario and to quickly discern which have been incorporated into a specific scenario.

*Deconstructed Scenarios*. Deconstructed scenarios show individual interactions between patients and the PCMH enterprise. They also show interactions among the various functional areas of the PCMH ecosystem that are not directly observed by the patient.

Based in part on the “play script” style of narrative process documentation, the contents of the deconstructed scenario are then reproduced in graphical form on the interaction diagram.

*Interaction Diagrams*. Using a canvas specifically prepared to contain all the sites, subsites, and roles represented in the scenario, lines and arrows representing the individual interactions that are spelled out in the deconstructed scenario are placed on the canvas. This combination of all the concepts and constructs along with the diagramming tools is known as the interaction diagram and is used to graphically illustrate the scenarios and the flow of information.

*Process Flow Diagrams*. While interaction diagrams illustrate who is interacting with whom, and the information flow(s) associated with a specific interaction, process flow diagrams show in detail the actions taking place within the various sites, subsites, and roles that are described in the scenario (or use case or test case).

These diagrams can be used to document the existing process (as is) or to describe the desired processes (to be). This process description can aid in defining the requirements for a health IT system. These process flow diagrams are discussed here only as a component of the framework because development of the diagrams was beyond the scope of this effort.

## Validation Process for PCMH Information Framework and Model

The expert advisory panel provided validation of the components and the approach to developing the information framework. The individual components of the information framework have been used for years in other industries; what is new is the arrangement and collective use of these components in defining a single integrated model. Additional validation of the framework by the health care community is warranted.

The process for validating the information model (e.g., the scenarios and interaction diagrams) started with input from the expert advisory panel regarding which attributes of the PCMH were the most important to model. Scenarios were then constructed, along with corresponding interaction diagrams. These constructs were reviewed by the expert advisory panel and then revised based on the panel’s input. A group of seven providers (representing small and large practices, rural and urban, primary care and multispecialty practices) were interviewed to validate the scenarios and interaction diagrams, and that input was used to revise the constructs and to provide discussion of the attributes that map to the scenarios. For each interaction diagram, a simplified diagram could be created to show how the patient would

interact with the health care system. The scenarios and simplified interaction diagrams could be used in focus groups with patients to validate the constructs and capture patient narratives about the scenarios and interactions.

## **A First Information Model for the PCMH**

The purpose of this first information model is to describe some of the interactions of the PCMH, as it would not be possible to describe all of the interactions in this single project. To help with constraining this first model, a working definition of the PCMH was created for this work. The working definition of the PCMH used for this project takes into account the definitions cited above, with a project-specific focus on patient experiences, clinical interaction and information flows, and the intended audiences (patients, providers, policymakers, and health IT vendors). For this project, the ***PCMH is an evolving, patient-centered, interconnected, health IT-enabled primary care delivery model that provides access to high-quality, coordinated, efficient, and satisfying care that promotes positive outcomes.***

Using this definition and focusing on the PCMH attributes that are thought to improve quality, lower cost, or differentiate the PCMH, a list of 44 of the total 59 attributes was selected for inclusion in the scenarios. From these attributes, a set of nine patient scenarios was constructed. We created three scenarios for each of the three categories of interactions (patient and PCMH, PCMH and subspecialty care, and PCMH and hospital care), resulting in a total of nine patient scenarios. These scenarios are prototypical and are intended to demonstrate the attributes of the PCMH. They do not represent the only way or the best way to implement the PCMH, nor do they represent every possible combination of attributes of a PCMH. Each scenario is followed by a discussion of the attributes that are reflected in the scenario. Appendix B provides a matrix of the mapped PCMH scenarios and attributes.

An interaction diagram follows the scenario and discussion of attributes. For the interaction diagram, the scenario is broken down into the relevant site, subsites, and roles. Implicit sites or roles may need to be explicitly identified. The interactions are then separated from each other and labeled with numbers, which are then used in the interaction diagram to code the lines. Each line represents a specific interaction between the involved actors, and the arrow points indicate the direction of information flow.

### **Interactions Focused on PCMH and Patient**

#### **Scenario Number 1: PCMH and Patient Interaction – Childhood Acute Illness**

The mother of 3-year-old Kyle Wilson reports that he has been irritable since yesterday and may have a slight fever since this morning. He also has a runny nose and is not as active as usual. She is concerned that Kyle may have an ear infection and, because today is Thursday, she doesn't want the problem to get worse over the weekend. She sends a secure message to Dr. Prima's office (the family's PCMH), and quickly receives a response from Dr. Prima's nurse, Gina, advising her to make an appointment for Kyle to be seen by Dr. Prima. Kyle's mother uses the clinic's secure patient portal to schedule an appointment for 7:00 p.m. (Dr. Prima has office hours until 7:30 p.m. on Tuesdays and Thursdays). Gina's message includes recommendations

for symptomatic treatment for Kyle and key symptoms that merit immediate notification to the clinic. The message also links to a tool on the Web site that can be used to calculate antipyretic (fever control) dosing for Kyle.

This scenario demonstrates the following attributes of the PCMH:

*Secure Messaging.* In this scenario, secure messaging is used to enhance access to the PCMH. There are multiple options for implementing secure messaging in a PCMH. The PCMH might offer a patient portal to provide this functionality, and could offer patients interoperability between their personal health records and the practice's electronic health records.

*Practice Web Site.* Establishing a practice Web site as a trusted site for patient educational information is a valuable way to provide quick access to needed health information.

*Patient Portal.* A patient portal extends a practice Web site to provide a secure location that patients can use to receive and send information related to their health and care. In this scenario, the portal is used to show available appointment times and allow the patient to select the best time. A portal can also allow patients to access their personal health information.

*Patient Education.* Educating patients about their health is an important part of health care delivery. In this scenario, the nurse's instructions to the patient in the secure message fulfilled this function, although that is only one of many ways patients are educated in a PCMH.

*Self-Care.* Patient engagement can be supported through the use of self-service tools. In this scenario, the patient uses a simple drug-dosing calculator to find the right dose for over-the-counter fever-control agents. More complex tools can be provided to support self-management of chronic diseases and wellness.

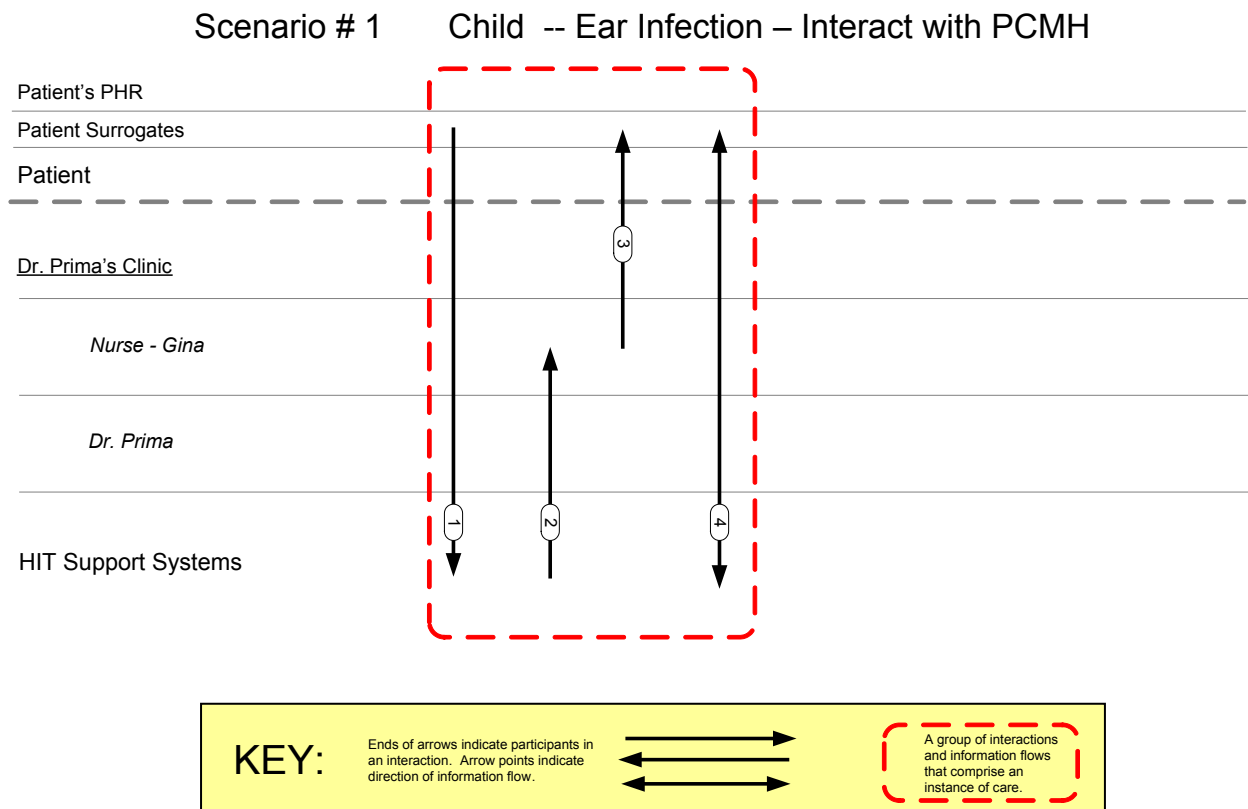
*Open-Access Scheduling.* The attribute is alluded to in this scenario through the use of the patient portal's online appointment scheduling capability. Open-access scheduling focuses on doing today's work today, so patients don't have to wait days, weeks, or longer for an appointment. Allowing the patient to create an appointment online is a useful option, but is not a requirement to achieve open-access scheduling.

*Extended Office Hours.* Enhanced access can be achieved by providing service outside of regular hours, such as on evenings or weekends. This provides more options for patients, especially those who have a typical work schedule. Another way to extend access is to partner with an urgent care clinic or other facility, while ensuring that information will flow between the PCMH and the contracted clinic to provide continuity of care.

Figure 6 is an interaction diagram of Scenario Number 1.



**Figure 6. Scenario 1 Interaction Diagram**



### **Dr. Prima's Office**

- Infrastructure Systems
  - Mrs. Wilson sends a secure message to Dr. Prima's office concerning her son Kyle's runny nose. (1)
- Nurse – Gina
  - Gina receives notification that a secure message has been received. (2)
  - Gina sends a response to Kyle's mother advising her to make a same-day appointment and includes recommendations on symptomatic treatment for Kyle and key symptoms about which to notify the clinic immediately. (3)
- Infrastructure Systems
  - Mrs. Wilson accesses the clinic's secure patient portal and secures an appointment for 7:00 PM that evening. (4)

## Scenario Number 2: PCMH and Patient Interaction – Adult Acute Illness

Steven Joplin, a 28-year-old with a one-week history of cough, now has a productive cough, fever, chills, and worsening fatigue. He presents to Dr. Prima's clinic after calling to schedule a morning visit. Ellie Forman, the receptionist, quickly verifies his demographic data and insurance eligibility and messages Dr. Prima's medical assistant, Donna McGowan, to get him back to a room as he appears moderately ill and uncomfortable. Donna obtains a history and vitals from Mr. Joplin (including pulse oximetry) and initiates one of the practice's standing protocols. CBC and chest x-ray results are available to Dr. Prima when he enters the room to evaluate Mr. Joplin. An acute left lower lobe pneumonia is diagnosed and an antibiotic is e-prescribed, but the first antibiotic dose is given in the office. Mr. Joplin heads home with a printed care plan including specific reasons to contact Dr. Prima prior to the scheduled followup visit. The care plan, and a copy of Dr. Prima's clinical note, is securely uploaded to Mr. Joplin's personal health record.

Within a couple of days, Mr. Joplin notes a rash across his chest and back. He takes a photograph and sends it securely to Dr. Prima, who elicits additional information from Steven via e-mail, and then concludes that Mr. Joplin has developed an allergic reaction to the antibiotic. He submits an alternate prescription to Steven's preferred pharmacy, updates his allergy data, and coordinates an updated care plan with Steven.

Six weeks later, Mr. Joplin receives an automated reminder that he is due for followup with Dr. Prima, and instructions for obtaining a repeat chest x-ray. Dr. Prima reexamines Steven and shows him the electronic x-ray images that reveal complete resolution of the infiltrate/pneumonia. Steven asks that the images be made available in his personal health record. He is reminded also that his entire health record is always available to him through the PCMH's secure patient portal.

This scenario demonstrates the following attributes of the PCMH:

*Secure Messaging.* In this scenario, secure messaging is used not only to communicate with the patient but also with care providers. The e-prescribing of the prescriptions and the eligibility verification demonstrate clinical messaging with other individuals and organizations in the care team. Intra-office messaging (the message from the receptionist to the medical assistant) also helps support team-based care.

*Patient Portal.* In this scenario, the patient portal is used as it is in Scenario 1. Furthermore, the patient is able to upload a picture of his rash and send it to the PCMH. The reminder for his followup also could be delivered through the portal.

*Patient Education.* The patient is given a copy of his care plan and patient instructions.

*Electronic Visit.* The interaction between the patient and provider regarding the rash is an example of an electronic visit. History taking, diagnostic evaluation, and medical decisionmaking all took place without the need of a face-to-face visit.

*Open-Access Scheduling.* Same-day appointments are a part of open-access scheduling.

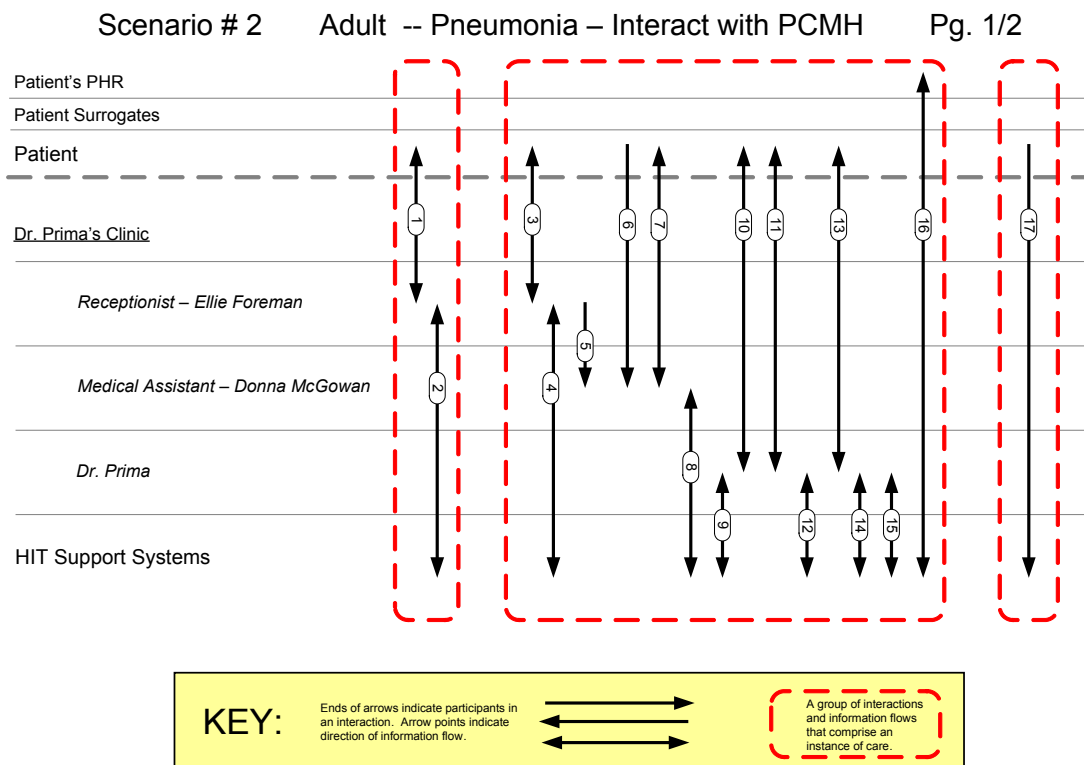
*Integrated Ancillary Services.* In this scenario, the laboratory and imaging diagnostics were available within the PCMH. Another approach is to contract with such services. The key interactions for integrating ancillary services are to understand the information needs of both parties (i.e., the PCMH and the ancillary service).

*Automated Technologies.* The patient reminder would have been set in the system at the time of the initial diagnosis of pneumonia. The health information system would then trigger the reminder when 6 weeks had passed. This could be done with a traditional paper tickler system, but the technology creates a streamlined, reliable process.

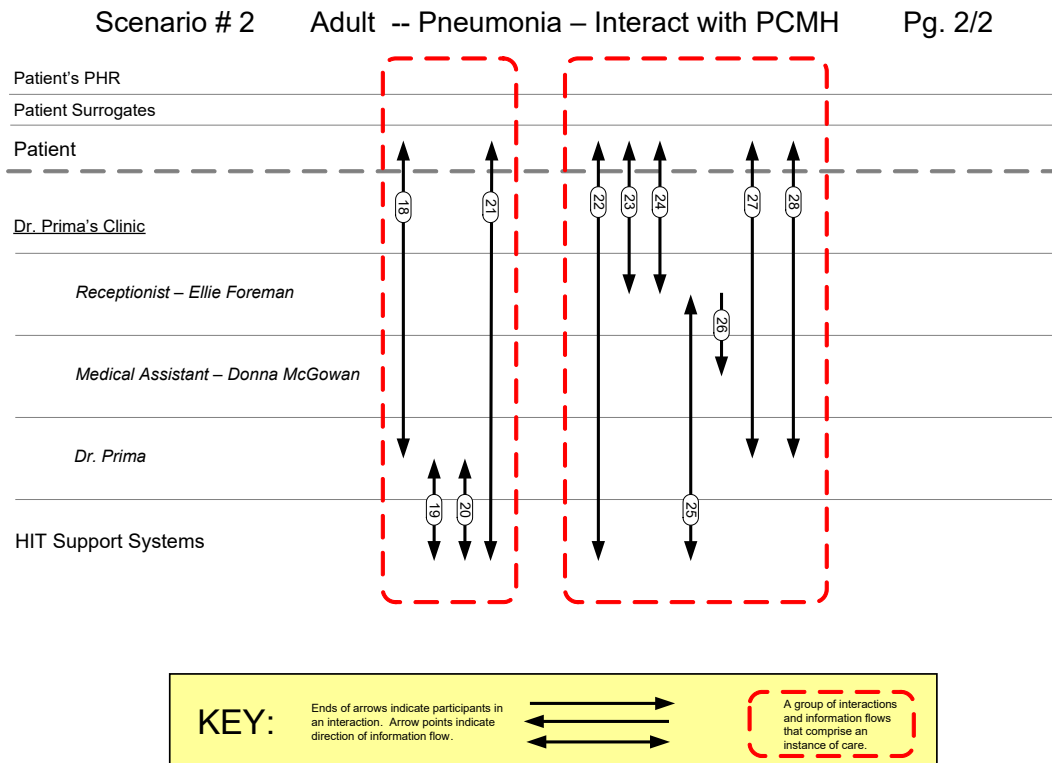
*Accessible Patient Health Information.* The patient is given an electronic copy of his health information. This makes the information accessible by others, should the patient wish to share it, perhaps with other care providers.

Figures 7 and 8 show Parts 1 and 2 of an interaction diagram of Scenario Number 2.

**Figure 7. Scenario 2 Interaction Diagram (Part 1)**



**Figure 8. Scenario 2 Interaction Diagram (Part 2)**



### Dr. Prima's Clinic

- Office Receptionist – Ellie Foreman
  - Receptionist receives a call from Steven Joplin to schedule a same-day appointment. (1)
  - Receptionist requests Mr. Joplin's medical records from Dr. Prima's HIT system. (2)
  - Mr. Joplin arrives at office and checks in with the receptionist. (3)
  - Receptionist quickly verifies his demographic data and insurance eligibility. (4)
  - Receptionist messages Dr. Prima's medical assistant to escort Mr. Joplin back to an exam room. (5)
- Dr. Prima's Medical Assistant – Donna McGowan
  - Medical assistant locates Mr. Joplin in waiting room and takes him back to exam room. (6)

- Medical assistant obtains a history and vitals from Mr. Joplin, including pulse oximetry. (7)
- Medical assistant initiates one of the practice's standing protocols including CBC and chest x-ray and enters data into Dr. Prima's HIT system. (8)
- Dr. Prima
  - Dr. Prima enters exam room and reviews CBC and chest x-ray data. (9)
  - Dr. Prima examines and evaluates Mr. Joplin. (10)
  - Dr. Prima diagnoses Mr. Joplin as having an acute left lower lobe pneumonia. (11)
  - Dr. Prima, using his HIT system, prescribes an antibiotic. (12)
  - Dr. Prima gives the first antibiotic dose in the office. (13)
  - Dr. Prima, using his HIT system, enters a clinical note and schedules a followup appointment for 6 weeks out. (14)
  - Dr. Prima, using his HIT system, produces a printed care plan with specific reasons for Mr. Joplin to contact him before the scheduled followup. (15)
  - Dr. Prima, using his HIT system, securely uploads a copy of the care plan and a copy of his clinical note to Mr. Joplin's PHR. (16)

## **Patient**

- Steven Joplin
  - Mr. Joplin notes a rash on his chest and back, takes a photograph, and sends it securely to Dr. Prima through the practice's secure patient portal. (17)

## **Dr. Prima's Clinic**

- Dr. Prima
  - Dr. Prima responds to Mr. Joplin by e-mail and elicits some additional details. (18)
  - Dr. Prima concludes that this is an allergic reaction to the antibiotic and, using his HIT system, submits an alternate e-prescription to Mr. Joplin's pharmacy. (19)
  - Dr. Prima, using his HIT system, updates Mr. Joplin's allergy list. (20)
  - Dr. Prima, using his HIT system, sends Mr. Joplin an updated care plan. (21)

## **Patient**

- Steven Joplin
  - Mr. Joplin receives a reminder that he is due for a followup visit with Dr. Prima and instructions on obtaining a repeat chest x-ray. (22)
  - Mr. Joplin calls Dr. Prima's office to arrange for an x-ray to be taken prior to his previously scheduled appointment. (23)

## **Dr. Prima's Clinic**

- Office Receptionist – Ellie Foreman
  - Mr. Joplin arrives at office and checks in with the receptionist. (24)
  - Receptionist quickly verifies his demographic data and insurance eligibility. (25)
  - Receptionist messages Dr. Prima's medical assistant to escort Mr. Joplin back to an exam room. (26)
- Dr. Prima
  - Dr. Prima reexamines Mr. Joplin and shows him the electronic x-ray images, revealing complete resolution of the infiltrate/pneumonia. (27)
  - Mr. Joplin asks that the images be made available in his PHR, and Dr. Prima responds that his entire health record, including the images, is always available to him through the practice's secure patient portal. (28)

## **Scenario Number 3: PCMH and Patient Interaction – Adult Acute Illness**

For several years, 33-year-old Natalie Brown has been seeing Dr. Prima for health maintenance and acute illnesses. Her parents also come to the clinic, but see another provider. Natalie has been experiencing worsening sadness over the last few months. She is not eating well, not sleeping well, and her family is very concerned about these changes. She arrives for her appointment with her husband. Physical exam is normal, she denies suicidal ideation, and social supports seem strong. She completes a standardized depression instrument in privacy on the exam room computer. Lab orders are sent electronically using the depression order set, and potential next steps and depression issues are fully discussed.

The following day, lab results are available to Dr. Prima (in his results workflow), and directly to Mrs. Brown, with all results normal. She starts a generic SSRI and uses a pedometer to track her activity. Step counts are uploaded to her computer and a weekly summary is sent securely to Dr. Prima. After 2 weeks, Dr. Prima increases the SSRI dose, with no side effects noted. After 6 weeks, with only slight symptomatic improvement noted on serial screening with a standardized depression instrument, Natalie and Dr. Prima decide that the SSRI is not helping enough. Natalie's pharmacy benefit requires prior authorization for an SNRI, which is

automatically generated by Dr. Prima's EHR system as he writes the e-prescription. Natalie has also started to see a local psychologist, Dr. Kryer, who, with her consent, sends assessments to Dr. Prima after their weekly visits.

This scenario demonstrates the following attributes of the PCMH:

*Patient Portal and Secure Messaging.* In this scenario, the patient uses the portal to upload her exercise history data. She also receives her lab results through the portal. Although the scenario is not constructed to have the patient perform the depression screening online, this could be another function of the portal.

*Self-Service Tools.* Using the portal, the patient is able to upload and view her progress on her exercise regimen.

*Electronic Visit.* The followup visit to check the efficacy of the initial treatment is done via secure messaging.

*Accessible Patient Health Information.* The patient is provided timely access to her lab results.

*Integrated Ancillary Services.* In this scenario, the laboratory testing is not provided within the PCMH. The integration of the services is through the use of electronic order entry and results delivery.

*Evidence-Based Best Practices.* The use of predefined order sets for lab testing for new-onset depression allows for quick and systemic use of best evidence.

*Electronic Orders and Results Management.* This is an important set of interactions to allow testing to be integrated into the patient's care.

*E-Prescribing.* Using e-prescribing, the health IT system can determine that the drug being prescribed requires a prior authorization. This streamlines the process, eliminating the need to obtain prior authorization after the patient has already tried to fill the drug at the pharmacy. That would cause frustration and potential rework for both the patient and the PCMH.

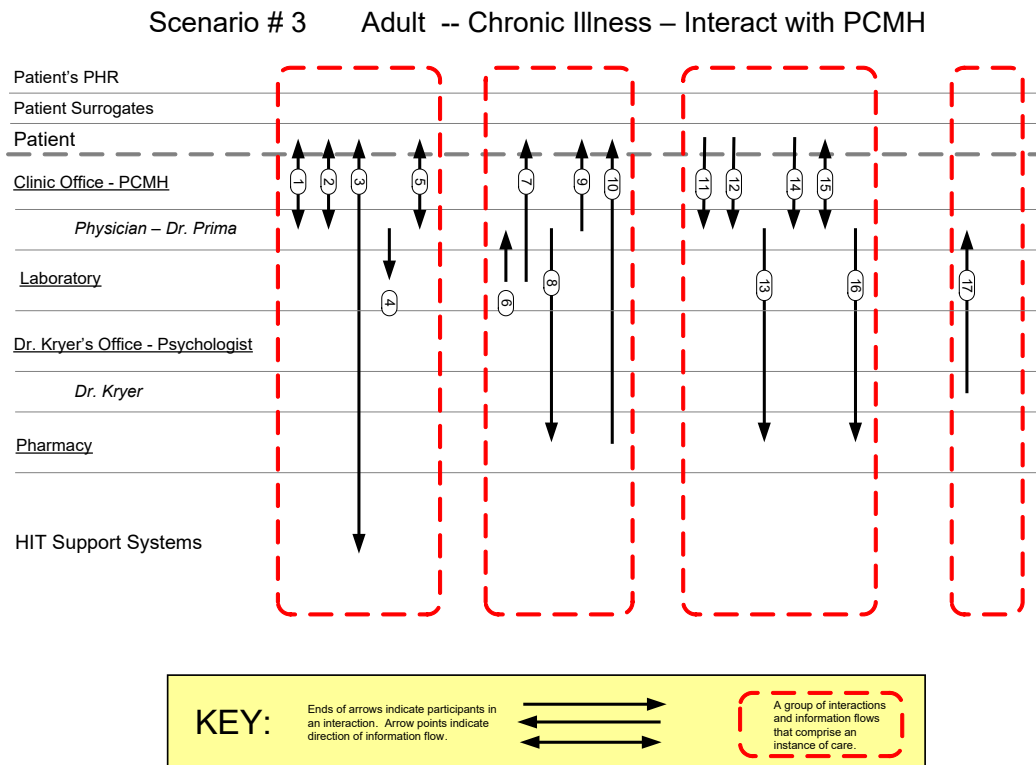
*Regulatory Compliance.* The identification of the need for prior authorization at the time of the prescription allows the PCMH to more easily comply with that administrative requirement.

*Integrate Disparate Data Sources.* The PCMH's health IT system is able to integrate the lab test results into the patient's record.

*Provider-to-Provider Communication.* To provide continuity of care and maximize the effect of treatment, the PCMH and the psychologist exchange routine updates. Another approach to integrating mental health is for the mental health provider to be housed within the PCMH.

Figure 9 shows an interaction diagram of Scenario Number 3.

**Figure 9. Scenario 3 Interaction Diagram**



### Clinic Office – PCMH

- Dr. Prima
  - Natalie Brown arrives for her appointment with her husband. (1)
  - Dr. Prima conducts physical exam. (2)
  - On Dr. Prima's advice, Natalie takes a standardized depression instrument on the exam room computer. (3)
  - Dr. Prima orders labs. (4)
  - Dr. Prima discusses potential next steps and depression issues. (5)



### **Laboratory**

- Unspecified Person
  - Transmits lab results to Dr. Prima. (6)
  - Transmits lab results direct to Natalie Brown. (7)

### **Clinic Office – PCMH**

- Dr. Prima
  - Dr. Prima prescribes a generic SSRI. (8)
  - Dr. Prima sends a note to Natalie telling her to take the SSRI he prescribed, use a pedometer, upload the data to her computer daily, and send a weekly report to him. (9)

### **Pharmacy**

- Unspecified person
  - Sends the SSRI to Natalie. (10)

### **Clinic Office – PCMH**

- Dr. Prima
  - Dr. Prima receives the first weekly pedometer report from Natalie. (11)
  - Dr. Prima receives the second weekly pedometer report from Natalie. (12)
  - Dr. Prima increases the SSRI dose. (13)
  - Dr. Prima receives sixth weekly pedometer report from Natalie. (14)
  - Dr. Prima consults with Natalie and they decide to change her prescription to an SNRI. (15)
  - Dr. Prima writes an SNRI e-prescription and a prior authorization form is automatically generated and sent to Natalie's pharmacy. (16)

### **Dr. Kryer's Office – Psychologist**

- Dr. Kryer
  - Sends first assessment to Dr. Prima after his first weekly session with Natalie. (17)

## Interactions Focused on PCMH and Subspecialty Clinic

### Scenario Number 4: PCMH and Subspecialty Clinic Interaction – Childhood Acute Illness

Jennifer Davis, a 9-year-old gymnast, fell on her right arm at practice yesterday. The coach appropriately recommended rest, ice, compression, and elevation, but Jennifer continues to have significant pain and swelling in her right wrist and doesn't want to use the hand. Dr. Prima examines the injured wrist and obtains x-rays, which reveal a fracture involving the growth plate. He splints the injured wrist and coordinates referral to Dr. Skelton, an orthopedic surgeon, after discussing possible complications and options with the Davis family.

Ellie Forman, the receptionist, works with the Davis family to schedule an appointment with Dr. Skelton for tomorrow morning and authorize the referral with their insurance carrier. Dr. Prima sends his visit summary and x-rays to Dr. Skelton and gives him access to Jennifer's full chart, if needed. Dr. Skelton determines that a cast will be sufficient and provides updates Dr. Prima at 3 and 6 weeks regarding Jennifer's recovery. Based on this information, when Jennifer's parents call for an activity release for her to return to gymnastics, Dr. Prima feels comfortable providing it electronically through the portal.

This scenario demonstrates the following attributes of the PCMH:

*Secure Messaging.* Since a visit was not required for the activity release, secure messaging through the portal was used to quickly fulfill the request.

*Patient Portal.* Use of the portal for the activity release request provides convenience for the Davis family.

*Accessible Patient Health Information.* Since the information about treatment by the orthopedic surgeon was included in the PCMH EHR, all the information is available to facilitate Dr. Prima's decision about activity release. Also, by sharing the patient's record, the orthopedic surgeon has all the needed information to treat the patient effectively.

*Integrated Ancillary Services.* The x-ray capability was integrated into the care of the patient. This could be provided in the practice or could be contracted out with proper relationships to ensure continuity of care.

*Supports Care Transition.* The orthopedic surgeon is provided access to the PCMH record to support continuity of care. Also, the patient's family is helped through the referral process. A practice in the provider workgroup has a process to push a care summary to the specialist and then allow the specialist to request or pull additional information (such as an x-ray) as needed.

*Provider-to-Provider Communication.* Communication happens before the transition of care and continues through the treatment by the orthopedic surgeon.

*Task Designation.* Dr. Prima tasks the receptionist to handle the referral. Dr. Prima should have the ability to see when the task is completed and see any outstanding tasks.

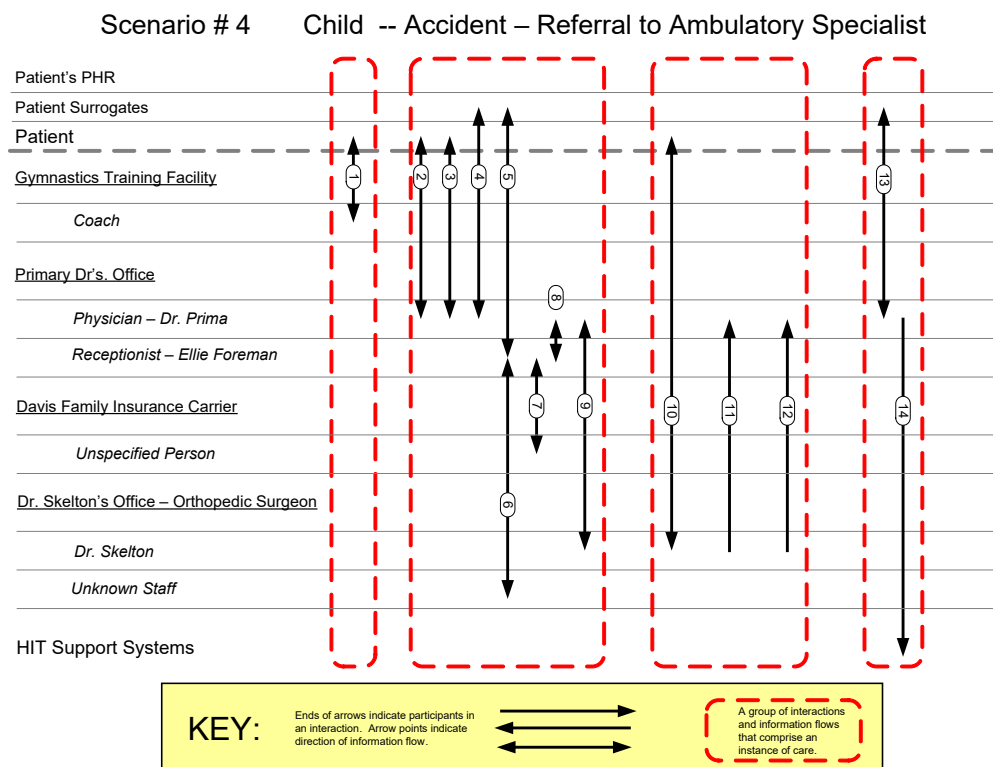
*Clear Employee Roles and Responsibilities.* Dr. Prima and the receptionist work well together because each employee has a clear set of roles and responsibilities.

*Risk Management.* Dr. Prima is able to manage the risk of the activity release request, with scheduling an unnecessary office visit.

*Engage Patient in Health Care Process.* The Davis family is part of the decision process, including the choice of provider for referral.

Figure 4 shows an interaction diagram of Scenario Number 4. Although this scenario does not include integration of care at the patient's school, one of the members of this project's provider workgroup reported working on this capability, to allow the school nurse to collaborate with the PCMH.

**Figure 10. Scenario 4 Interaction Diagram**



### **Gymnastics Training Facility**

- Coach
  - Jennifer Davis falls on right arm and her coach recommends rest, ice, compression, and elevation. (1)

### **Dr. Prima's Clinic**

- Dr. Prima
  - Dr. Prima examines Jennifer's injured wrist and obtains x-rays. (2)
  - Dr. Prima splints the injured wrist. (3)
  - Dr. Prima discusses possible complications and options with the Davis family, and they decide on a referral to Dr. Skelton, an orthopedic surgeon. (4)
- Office Receptionist – Ellie Foreman
  - Ellie coordinates with the Davis family to arrange for an appointment with Dr. Skelton for the following morning. (5)
  - Ellie coordinates with Dr. Skelton's staff to schedule an appointment for Jennifer the following morning. (6)
  - Ellie interacts with the Davis family insurance carrier to authorize a referral from Dr. Prima to Dr. Skelton. (7)
  - Ellie notifies Dr. Prima that all the logistical steps to refer the patient and set the appointment have been completed. (8)
- Dr. Prima
  - Dr. Prima sends his visit summary and x-rays to Dr. Skelton and gives him permission to access Jennifer's full chart (on Dr. Prima's EHR) if needed. (9)

### **Dr. Skelton's Office**

- Dr. Skelton
  - Dr. Skelton sees Jennifer and determines that a cast will be sufficient. (10)
  - Dr. Skelton issues a status report to Dr. Prima at 3 weeks. (11)
  - Dr. Skelton issues a status report to Dr. Prima at 6 weeks. (12)

### **Dr. Prima's Clinic**

- Dr. Prima
  - Receives a call from Jennifer's parents asking for an activity release. (13)
  - Dr. Prima creates the release and makes it available on the portal. (14)

## **Scenario Number 5: PCMH and Subspecialty Clinic Interaction – Adult Prevention**

During a well-patient exam, 47-year-old Amy Smith notes significant stressors at work but describes home life as good. Physical exam and Pap smear are normal. Screening labs are within normal range, though her cholesterol values have been trending up in recent years. Mammography shows a new, suspicious finding in the right breast. Diagnostic images and ultrasound are obtained while she is still at the imaging center. Dr. Prima discusses the findings and options with Amy by phone and they decide on referral to Dr. Mallory, a breast surgeon, for further evaluation. Dr. Prima forwards to Dr. Mallory Amy's medical history, current and prior radiology studies, and a personal note regarding Amy's social supports and recent increased stressors.

When seen by Dr. Prima for an acute illness, Amy's husband asks for updates on Amy's conditions. After confirming in the EHR that Amy previously consented to sharing of information with her husband, Dr. Prima answers his questions about Amy based on updates from Dr. Mallory, and discusses the current treatment plan. Dr. Prima calls to follow up with Amy and her husband about the negative biopsy results as soon as they are available.

This scenario demonstrates the following attributes of the PCMH:

*Secure Messaging.* This is used to share the patient's information with the breast surgeon.

*Accessible Patient Health Information.* The breast surgeon has all of the patient information before the visit.

*Integrated Ancillary Services.* X-ray and laboratory results are integrated into the electronic medical record. Communication between the imaging center and PCMH extends the orders to include the diagnostic imaging after the screening mammogram. This did not require the patient to make another trip to the imaging center, and thus accelerated resolution of the issue.

*Provider-to-Provider Communication.* Both the raw medical data and the concerns of the patient are communicated.

*Clear Employee Roles and Responsibilities.* The imaging center had clear roles to perform additional diagnostic testing if needed. The PCMH was available should additional orders be needed.

*Comprehensive Care.* The PCMH was able to help the patient with preventive screening, handle management of the breast mass, and address the mental health of the patient.

*Prevention/Screening.* An annual well-patient exam was performed.

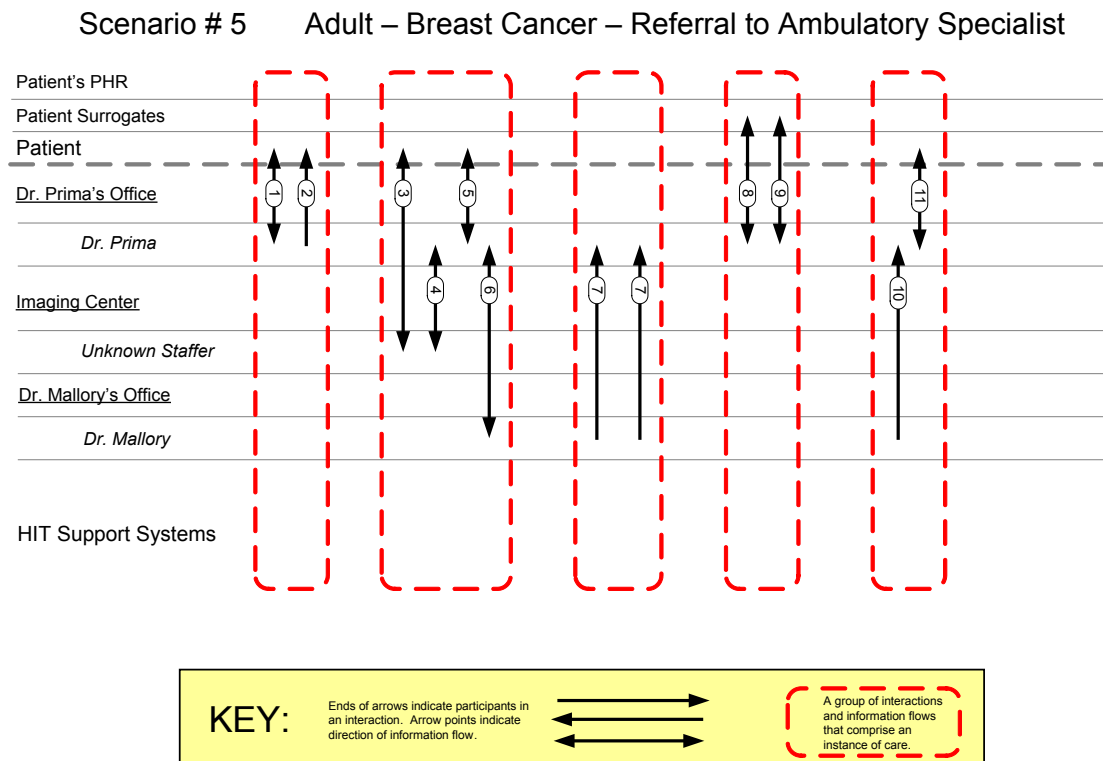
*Multidisciplinary Team.* The PCMH, imaging center, and breast surgeon all worked together to deliver efficient, seamless care to the patient.

*Integrate Family and Community Information.* At the direction of the patient, the family was brought into the care of the patient.

*Confidentiality and Security.* The PCMH managed consent to allow the patient's information to be shared with family members.

Figure 11 shows an interaction diagram of Scenario Number 5.

**Figure 11. Scenario 5 Interaction Diagram**



### **Dr. Prima's Office**

- Dr. Prima
  - Amy Smith is seen by Dr. Prima for her well-patient exam. (1)
  - Dr. Prima refers Amy to a remotely located imaging center for additional tests. (2)

### **Imaging Center**

- Unknown Staffer
  - Performs diagnostic image tests, including ultrasound. (3)
  - Notifies Dr. Prima by phone of Amy's results. (4)

### **Dr. Prima's Office**

- Dr. Prima
  - Dr. Prima speaks with Amy by telephone while she is still at the imaging center; they agree on a referral to Dr. Mallory, a breast surgeon. (5)
  - Dr. Prima forwards Amy's medical history, current and prior radiology studies, and a personal note to Dr. Mallory. (6)

### **Dr. Mallory's Office**

- Dr. Mallory
  - Dr. Mallory sends regular updates on Amy's condition to Dr. Prima. (7)

### **Dr. Prima's Office**

- Dr. Prima
  - Amy's husband, Mr. Smith, comes to see Dr. Prima for an acute illness. (8)
  - Based on updates from Dr. Mallory and documented consents, they are able to discuss Amy's current treatment plan. (9)

### **Dr. Mallory's Office**

- Dr. Mallory
  - Dr. Mallory sends a message to Dr. Prima that Amy's biopsy was negative. (10)

### **Dr. Prima's Office**

- Dr. Prima
  - Dr. Prima calls to follow up with Amy and her husband on the negative biopsy results as soon as they are available. (11)

## **Scenario Number 6: PCMH and Subspecialty Clinic Interaction Adult – Chronic Disease**

Mr. Johnson, a 52-year-old with hypertension, type 2 diabetes, and high cholesterol, has a fainting spell over the weekend. He calls his doctor, who recommends that he be seen in the office on Monday morning. Mr. Johnson calls his doctor's office on Monday morning, and since the practice has open-access scheduling, he is seen that day. When Mr. Johnson gets to the practice, he is presented with a form containing his medical information and asked to make any necessary changes or additions. Mr. Johnson is surprised to see the lab values from his visit just last week with Dr. Smith, his endocrinologist. Mr. Johnson sees the nurse, who helps enter the

modified information into his medical record, then uses a decision tree for syncope to ask additional questions of Mr. Johnson. Dr. Peter, Mr. Johnson's personal physician, meets and examines Mr. Johnson. They decide that, with his history, he should have a full cardiology workup. Based on evidence on who would be the best cardiologist for Mr. Johnson, they pick Dr. Connor. Dr. Peter attaches a care summary to an electronic message to Dr. Connor asking for a cardiac evaluation for syncope. Mr. Johnson is asked if he would rather have an e-mail interaction to set up the appointment, or if he would like Mrs. Cordey, the practice's coordinator, to meet with Mr. Johnson now, get his preferences for an appointment, and then call him when the appointment is made. Mr. Johnson prefers the personal touch.

Later that week, Mr. Johnson shows up at his appointment with Dr. Connor. When he meets Dr. Connor for the first time, Dr. Connor already knows almost everything about Mr. Johnson's condition, since all of Mr. Johnson's information has been loaded into his EHR. At the end of the visit, Dr. Connor sends a quick message to Dr. Peter letting him know they will be doing a 24-hour Holter monitor study to rule out dysrhythmia.

This scenario demonstrates the following attributes of the PCMH:

*Open-Access Scheduling.* A feature of open-access scheduling is the ability to have same-day appointments for urgent and non-urgent issues.

*24/7 Emergency Access Directly to Physician.* The patient is able to get to a provider regardless of the time or day of the week. This may be his personal provider or another provider who is covering for his provider. If it is a covering provider, he or she would have access to the electronic health record and would communicate information about any encounters to the personal provider.

*Patient Participation.* The patient is part of the referral decision process.

*Multidisciplinary Team.* The referral specialist, nurse, and primary care provider work together to provide the care to the patient in the PCMH.

*Evidence-Based Best Practices.* The best evidence would include outcomes data from the different providers and organizations to whom the PCMH refers patients.

*Electronic Medical Record.* The electronic medical record gives the provider access to the patient chart even after hours. The electronic medical record also supports the interoperability of data between the PCMH and the subspecialty clinic.

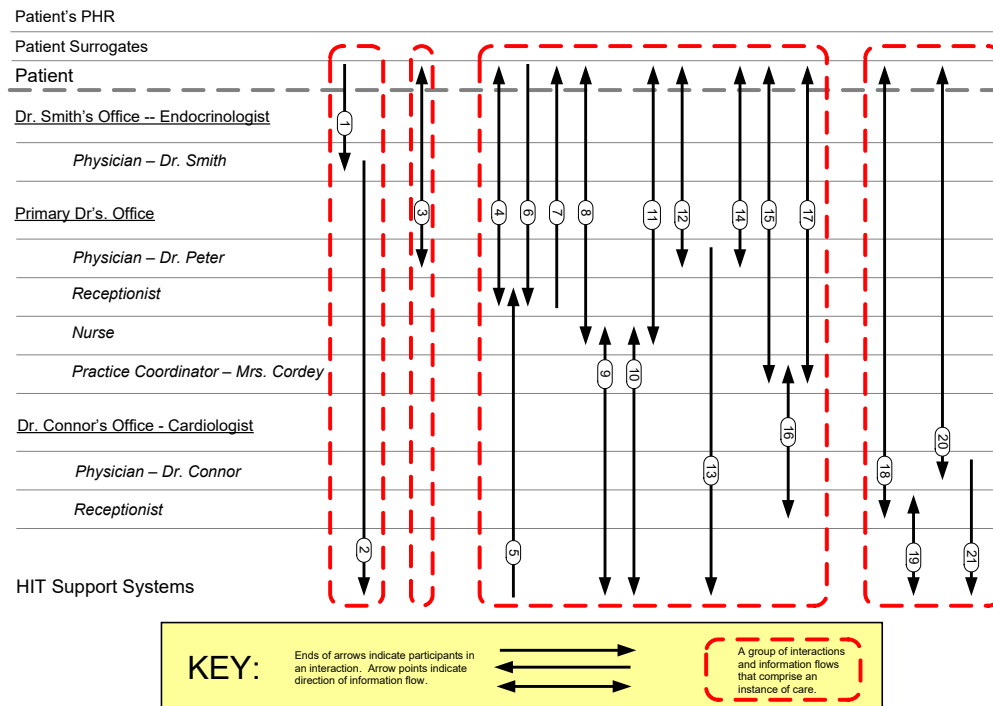
*Electronic Orders and Results Management.* The results for laboratory tests ordered by another provider are retrieved and integrated into the patient's record.

Figure 12 shows an interaction diagram of Scenario Number 6.



**Figure 12. Scenario 6 Interaction Diagram**

Scenario # 6 Adult -- Chronic Illness – Referral to Ambulatory Specialist



### Dr. Smith's Office

- Mr. Johnson visits Dr. Smith's office. (1)
- Dr. Smith sends Mr. Johnson's lab values to some unknown HIT service. (2)

### Primary Doctor's (Dr. Peter) Office

- Dr. Peter
  - Mr. Johnson calls Dr. Peter on the weekend. (3)
- Office Receptionist
  - Mr. Johnson calls to make appointment. (4)
  - Receptionist requests Mr. Johnson's medical updates since last visit from some unknown HIT service. (5)

- Mr. Johnson arrives at office and checks in with receptionist. (6)
- Receptionist provides preprinted form for him to validate and add updated information. (Form shows lab values from prior week visit to his endocrinologist, Dr. Smith.) (7)
- Office Nurse
  - Mr. Johnson meets with nurse, who reviews form with him. (8)
  - Nurse enters Mr. Johnson's test results into his medical record. (9)
  - Nurse accesses online patient interview application. (10)
  - Nurse asks Mr. Johnson syncope-related questions (using decision tree) and enters information into application. (11)
- Dr. Peter
  - Mr. Johnson has exam. (12)
  - Dr. Peter sends message to Dr. Connor with attached care summary via some unknown HIT service. (13)
  - Mr. Johnson is offered option by Dr. Peter to set e-mail appointment with Dr. Connor directly or have Mrs. Cordey (Dr. Peter's practice coordinator) handle it. Mr. Johnson decides to have the appointment coordinated by Mrs. Cordey. (14)
- Mrs. Cordey (Dr. Peter's practice coordinator)
  - Mr. Johnson meets with Mrs. Cordey and discusses available times. (15)
  - Mrs. Cordey coordinates future appointment with Dr. Connor's receptionist. (16)
  - Mrs. Cordey advises Mr. Johnson date and time of appointment. (17)

### **Dr. Connor's Office**

- Dr. Connor's Receptionist
  - Mr. Johnson arrives for appointment. (18)
  - Receptionist ensures that medical files are updated with latest information by inquiring of some unknown IT service. (19)

- Dr. Connor
  - Mr. Johnson sees Dr. Connor for exam/tests and sees care summary that had been sent earlier by Dr. Peter. (20)
  - At the end of the session, Dr. Connor sends a brief message to Dr. Peter—via some unknown HIT service—that he will be conducting a King of Hearts Holter Monitor study to rule out dysrhythmia. (21)

## Interactions Focused on PCMH and Inpatient Care

### Scenario Number 7: PCMH and Inpatient Interaction – Young Adult Acute Illness

Mary Jones is a previously healthy 17-year-old recently seen for a sports physical. Her immunizations are up to date. Her mother calls after regular office hours, noting that Mary has complained of worsening abdominal pain through the evening. She now has a fever, nausea, and doesn't want to move at all. Dr. Prima recommends immediate evaluation in the local emergency department. He contacts Dr. Statton at the Harley Street Hospital ED, relaying Mary's immediate story and providing her health history and most recent evaluation electronically, through remote access to his clinic's EHR system. Mary's CT scan reveals acute appendicitis and Dr. Statton contacts Dr. Prima to identify a surgeon of choice. Dr. Steele is consulted, provided with Mary's complete history, including latex allergy, and he performs surgery that night. Mary is discharged to home late the next day, with followup appointments established with Dr. Steel and Dr. Prima. All reports are forwarded to Dr. Prima's EHR at Mary's discharge.

This scenario demonstrates the following attributes of the PCMH:

*Accessible Patient Health Information.* The patient's information is made available to the emergency room prior to her arrival.

*Supports Transition of Care.* In addition to the transfer of the patient's electronic information, the patient's personal physician notifies the emergency room physician by phone about the patient and their interaction.

*Provider-to-Provider Communication.* The communication between providers ensures continuity of care. It also ensures that the receiving provider is aware of any pertinent medical issues with the patient.

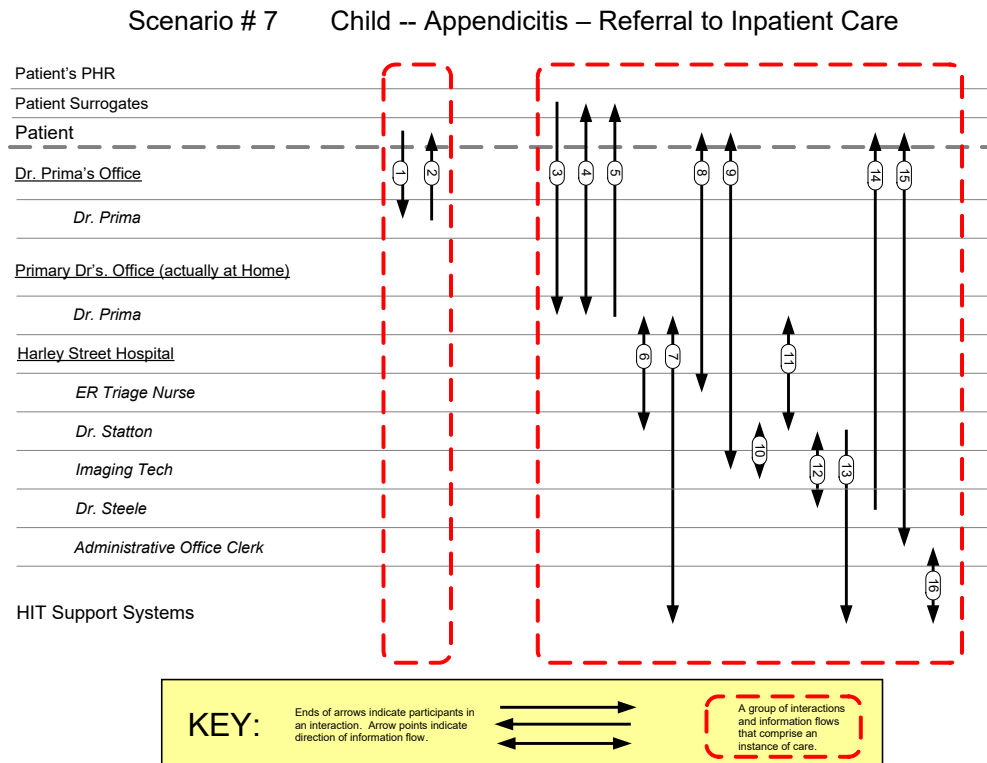
*Coordination/Integration of Care.* The transitions of care between the PCMH, emergency room, surgeon, and followup are seamless to the patient. Each transition also includes transfer of information needed to support safe and efficient care.

*24/7 Emergency Access Directly to Physician.* The patient's personal physician or an informed covering provider is available for consultation whenever needed by the patient.

*Wellness Promotion.* The patient was supported to ensure that her immunizations were up to date.

Figure 13 shows an interaction diagram of Scenario Number 7.

**Figure 13. Scenario 7 Interaction Diagram**



### Dr. Prima's Office

- Dr. Prima
  - Mary Jones is examined by Dr. Prima for a sports physical. (1)
  - Mary Jones is informed by Dr. Prima that she is cleared to play sports and that her immunizations are up to date. (2)

### Dr. Prima's Office (actually at his Home)

- Dr. Prima
  - Receives an after-hours call from Mary's mother, Mrs. Jones. (3)
  - Mrs. Jones describes, and he listens to and evaluates, Mary's symptoms. (4)
  - He tells Mary's mother to immediately take Mary to Harley Street Hospital ER and that he will phone ahead to coordinate her care there. (5)

- He contacts Dr. Statton at Harley Street Hospital and advises that Mary Jones is en route based on his orders. (6)
- Remotely accessing his office EHR system, he directs that it electronically send his notes on Mary's current condition, her health history, and most recent evaluation results to Dr. Statton. (7)

### **Harley Street Hospital**

- ER Triage Nurse
  - Mary and her mother arrive at the hospital ER and are greeted by triage nurse. (8)
  - The triage nurse, referring to instructions received from Dr. Statton, directs Mary to imaging for a CT scan. (9)
- Dr. Statton
  - Reviews CT scan results, which reveal acute appendicitis. (10)
  - Contacts Dr. Prima by phone to identify a surgeon of choice. and they decide on Dr. Steele. (11)
  - Conferences in Dr. Steele and, after being briefed, Dr. Steele agrees to perform surgery that evening at Harley Street Hospital. (12)
  - Forwards the medical history he has received from Dr. Prima and the CT scan results to Dr. Steele so they will be waiting for him when he arrives at the hospital. (13)
- Dr. Steele
  - Performs surgery. (14)

### **Harley Street Hospital**

- Administrative Office Clerk
  - Mary is discharged. (15)
  - Per orders received from Dr. Statton, all relevant reports are sent electronically to Dr. Prima. (16)

## Scenario Number 8: PCMH and Inpatient Care Interaction – Senior Chronic Disease

Susan Miller is a 72-year-old woman with a history of moderate chronic obstructive pulmonary disease after smoking for 40 years. She has a chronic cough but notes that it has become productive of purulent sputum in the last 3 days, along with increasing shortness of breath. Her baseline FEV<sub>1</sub>/FVC is 45 percent. Pulse oximetry reveals a SaO<sub>2</sub> of 88 percent on room air. Chest x-ray shows no infiltrate. CBC shows mild WBC elevation. Susan and Dr. Prima decide on admission to Harley Street Hospital for COPD exacerbation. Given Susan's current clinical findings, the clinical decision support-based order set suggests initiation of antibiotics. Admission information, history and physical exam note, and orders are received by the hospital; a room, nursing staff, and therapeutic interventions are ready for Susan on her arrival. Dr. Alvey, the consulting pulmonologist, verifies her treatment plan electronically and sees her the next morning. Susan improves over the next 3 days and is discharged with home health care, respiratory therapy, and supplemental oxygen all ready for her at home. The consultant's care plan is modified slightly by Dr. Prima, with the adjustments reviewed and accepted by Dr. Alvey prior to Susan's discharge. Followup visits are also scheduled before she goes home. Dr. Prima takes this opportunity to review his entire population of patients with COPD in his practice's disease registry. Based on this experience, he implements a quality improvement effort to reduce hospitalizations in his COPD patients.

This scenario demonstrates the following attributes of the PCMH:

*Accessible Patient Health Information.* The patient health information is accessible at each transition of care.

*Population Management and Registry.* The PCMH takes an inventory of the quality of care provided to all patients with a particular condition.

*Chronic Disease Management.* Patients with chronic disease are actively managed to optimize their outcomes and minimize their costs.

*Supports Care Transitions.* The patient sees a seamless transition of care, from the ambulatory setting to the inpatient setting and back to the ambulatory setting.

*Provider-to-Provider Communication.* The patient's personal physician makes sure that all providers are up to date about the patient's care plan and the activities of the other providers.

*Coordination/Integration of Care.* The providers work on a common plan of care.

*Multidisciplinary Team.* The personal physician and pulmonologist work together as members of a team to coordinate and integrate care.

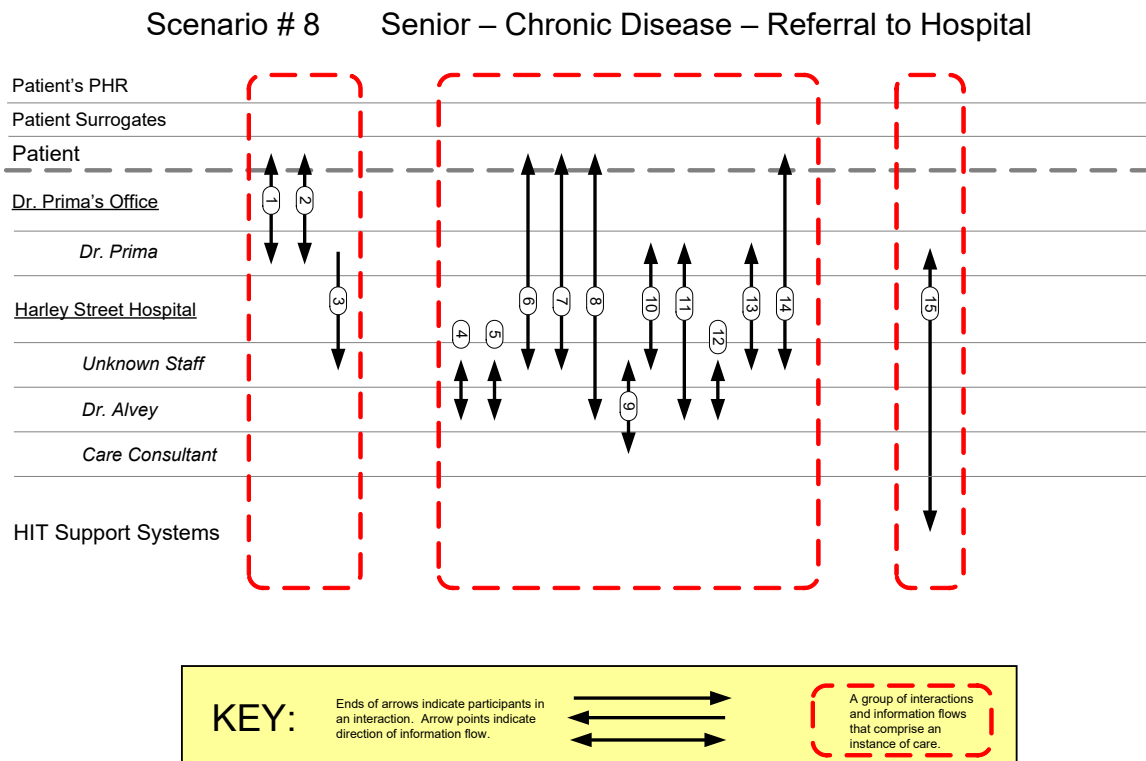
*Clinical Outcomes Analysis and Quality Improvement.* Using the patient registry, the PCMH can measure outcomes for chronic disease and work to improve those measures.

*Electronic Medical Record.* It is a critical piece to support the advanced activities of the PCMH.

*Evidenced-Based Decision Support.* The use of standardized order set for common issues ensures that things are not forgotten.

Figure 14 shows an interaction diagram of Scenario Number 8.

**Figure 14. Scenario 8 Interaction Diagram**



### **Dr. Prima's Office**

- Dr. Prima
  - Dr. Prima examines Susan Miller and reviews results of tests conducted in his office. (1)
  - Dr. Prima and Susan decide an admission to Harley Street Hospital is warranted. (2)
  - Dr. Prima sends admission information, history and physical exam note, and orders to the hospital so it can prepare for Susan's arrival. (3)

### **Harley Street Hospital**

- Unknown Staff
  - Notifies Dr. Alvey of receipt of Susan's information from Dr. Prima and sends copy of information. (4)
- Dr. Alvey
  - Verifies Susan's treatment plan electronically. (5)
- Unknown Staff
  - Admits Susan. (6)
  - Provides treatment according to plan. (7)
- Dr. Alvey
  - Visits Susan in her room. (8)
- Care Consultant
  - Prepares and submits a post-discharge care plan. (9)
- Unknown Staff
  - Forwards consultant's post-discharge care plan to Dr. Prima for review and approval. (10)

### **Dr. Prima's Office**

- Dr. Prima
  - Reviews consultant's post-discharge care plan, makes minor adjustments, and forwards plan to Dr. Alvey for his concurrence. (11)

### **Harley Street Hospital**

- Dr. Alvey
  - Dr. Alvey notes his approval and forwards post-discharge care plan to hospital administration. (12)



- Unknown Staff
  - Communicate with Dr. Prima to schedule specific followup visits for Susan at his office prior to discharging Susan. (13)
  - Reviews post-discharge plans with Susan and discharges her. (14)

### **Dr. Prima's Office**

- Dr. Prima
  - Reviews entire population of patients with COPD in his practice's disease registry. (15)

### **Scenario Number 9: PCMH and Inpatient Care Interaction – Senior Acute Illness**

Roberto Morales, an 81-year-old, is brought to Dr. Prima's office by his son without an appointment. Mr. Morales is acutely weak and somewhat confused, and complains of blood in his stools. Spanish is his primary language and translation services are accessed. He appears pale with an elevated pulse, but his blood pressure is normal. Stool is grossly bloody and hemoglobin is 6.5 (had been 12.5 3 months ago). Dr. Prima contacts Dr. Statton at the local emergency department by phone and forwards his current evaluation and Mr. Morales' medical history. Ambulance services are contacted for transport of Mr. Morales to Harley Street Hospital ED. Paramedics arrive at Dr. Prima's office and take Mr. Morales out through a special side entrance, thereby avoiding the reception area. Mr. Morales is further evaluated in the ED and admitted to ICU for close monitoring by Dr. Crittenden. His most recent advance directive and durable power of attorney for health care are included in the records from Dr. Prima. Emergent consultation is made to Dr. Collins, gastroenterology, who reviews electronic summaries of Mr. Morales' entire record and performs colonoscopy and EGD. Results of these evaluations are immediately available to Dr. Prima. Mr. Morales receives blood transfusions and his condition stabilizes, but no definitive source of bleeding is found, even after additional technical evaluations of the GI tract. Dr. Prima attends to Mr. Morales and his family while he is hospitalized. Though still weak, Mr. Morales and his family refuse temporary nursing home placement, and home assistance is arranged with family members, home health services, and community assistance programs for the elderly. The Morales family is very uncomfortable that the source of bleeding was not identified. Dr. Prima reviews with them the previous interventions and the most recent evidence for the care plan. They are reassured that all appropriate measures have been taken and that Roberto will continue to be followed closely by trained health care providers through home care, e-visits, and office visits. Educational materials in English and Spanish are provided to family members who are assisting with his acute recovery.

This scenario demonstrates the following attributes of the PCMH:

*Accessible Patient Health Information.* The patient's health information and condition is made available to the emergency room.

*24/7 Emergency Access.* Even during business hours, the PCMH practice must support emergency access. If the patient or patient's family had called the practice, they would have been directed to call 911 for an ambulance to the emergency room.

*Provider-to-Provider Communication.* The patient's personal physician has direct communications with the patient's other providers. All providers on the care team communicate with each other to help ensure coordination of care.

*Coordination/Integration of Care.* The transitions of care are seamless to the patient and all needed information is actively shared.

*Integrated Ancillary Services.* Basic laboratory testing is available in the PCMH (i.e., hemoglobin testing).

*Supports Care Transitions.* The PCMH actively manages the transition of care, making sure that receiving providers understand what is going on with the patient and why there is a transition of care.

*Integrate Family and Community Information.* The patient's family members are critical participants in the patient's care and are integrated into the care delivery process.

*Optimized Office Design.* The PCMH facilities were carefully designed to support a patient-centered approach to care. In this example, the design eliminates the spectacle of the patient being paraded through the waiting room on a stretcher.

*Personal Physician.* The patient's physician takes responsibility for all of the patient's care.

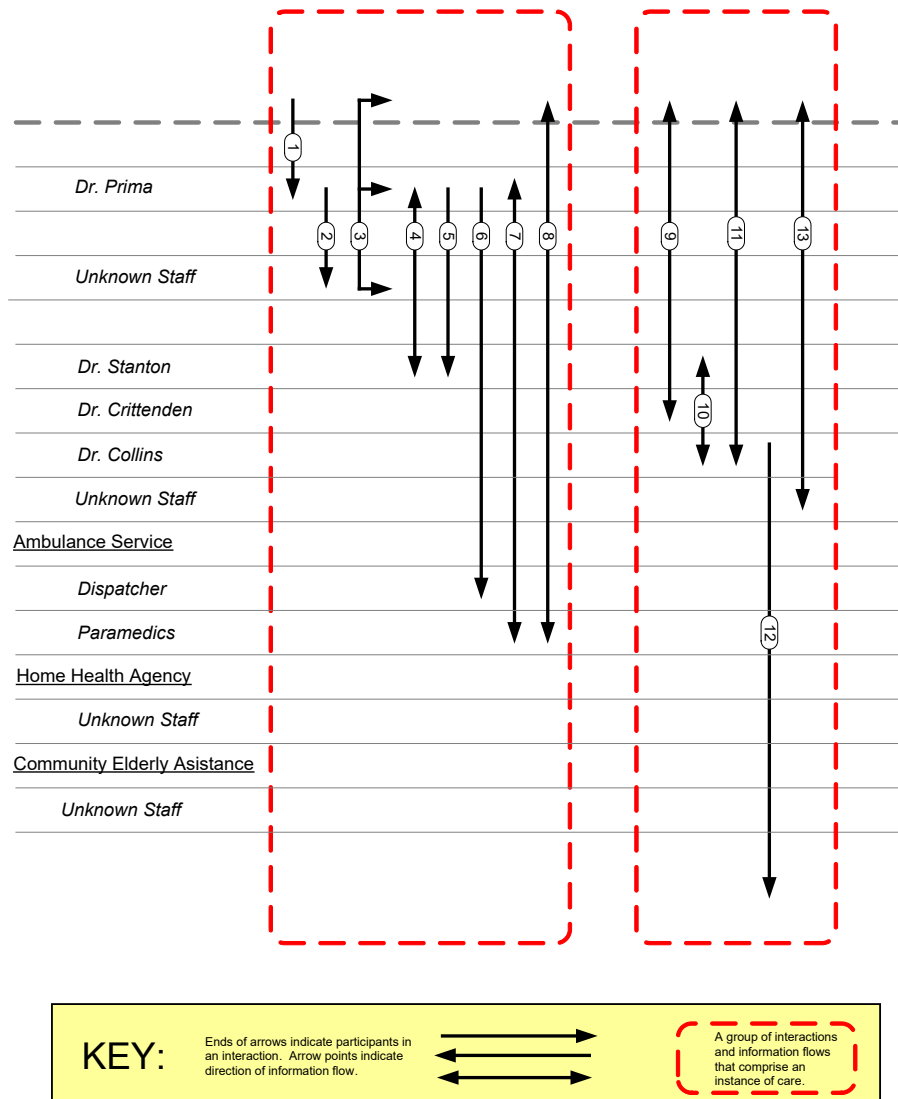
*Whole-Person Orientation.* All aspects of care, including socioeconomic issues, are managed by the PCMH.

*Language, Cost, and Needs Appropriate.* Translation services and patient education materials in Spanish were made available to the patient.

Figures 15 and 16 show Parts 1 and 2 of an interaction diagram of Scenario Number 9.

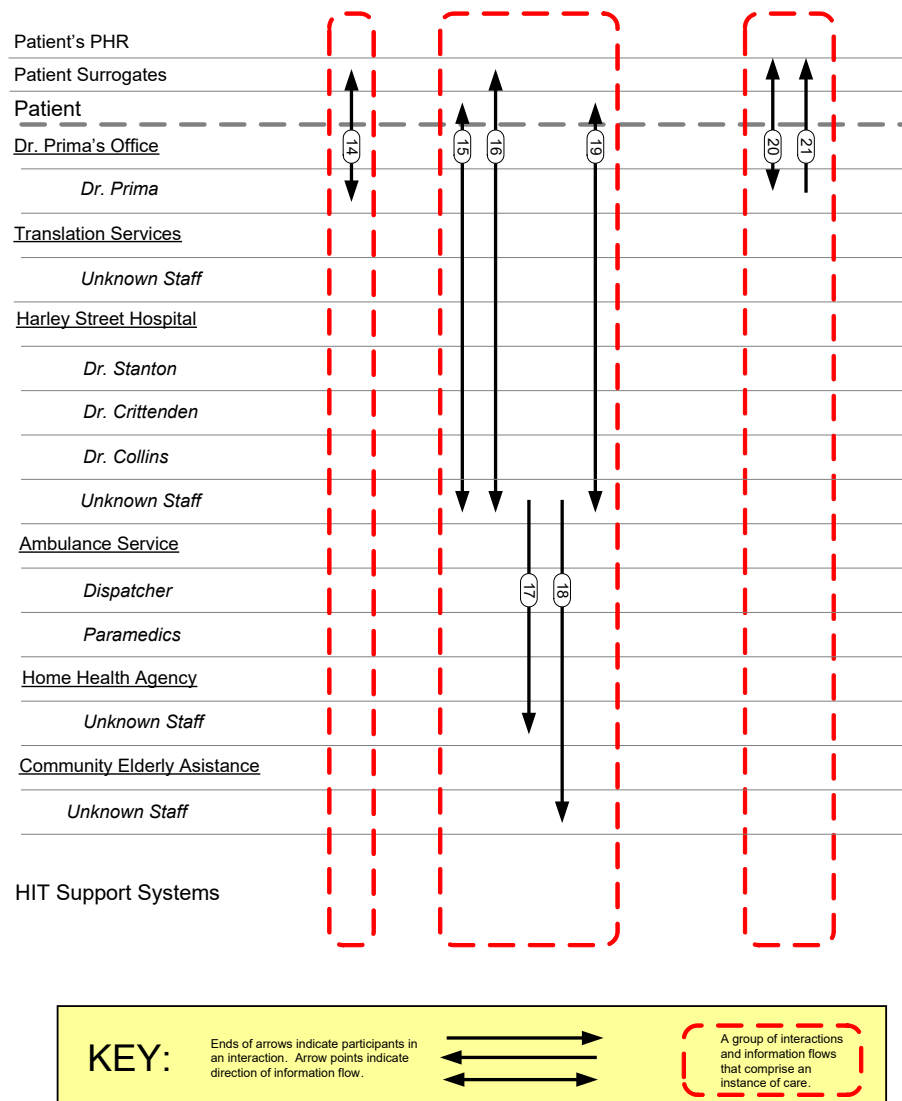
**Figure 15. Scenario 9 Interaction Diagram (Part 1)**

Scenario # 9 Senior – Acute Illness – Referral to Hospital 1/2



**Figure 16. Scenario 9 Interaction Diagram (Part 2)**

**Scenario # 9 Senior – Acute Illness – Referral to Hospital 2/2**



**Dr. Prima's Office**

- Dr. Prima
  - Roberto Morales, accompanied by his son, arrives without an appointment to see Dr. Prima. (1)
  - Because Spanish is Mr. Morales' primary language, Dr. Prima engages translation services. (2)
  - Translation services facilitates communication between Dr. Prima and Mr. Morales. (3)

- Dr. Prima contacts Dr. Statton at the local ED to discuss the situation. (4)
- Dr. Prima forwards Mr. Morales' current evaluation and his medical history to Dr. Statton. (5)
- Dr. Prima contacts ambulance service to arrange for transport of Mr. Morales from his office to Harley Street Hospital ED. (6)

### **Ambulance Services**

- Paramedics
  - Arrive at Dr. Prima's office as directed and meet Dr. Prima. (7)
  - Transport Mr. Morales from Dr. Prima's office to Harley Street Hospital ED. (8)

### **Harley Street Hospital**

- Dr. Crittenden
  - Mr. Morales is evaluated on arrival by Dr. Crittenden and admitted to ICU for close monitoring. (9)
  - Dr. Crittenden contacts Dr. Collins and forwards electronic summaries of Mr. Morales' entire record. (10)
- Dr. Collins
  - Perform a colonoscopy and EGD on Mr. Morales. (11)
  - Ensures that the results of those evaluations are immediately available to Dr. Prima. (12)
- Unknown Staff
  - Mr. Morales receives transfusions and additional evaluations of the GI tract. (13)

### **Dr. Prima's Office**

- Dr. Prima
  - Visits Mr. Morales and his family at Harley Street hospital. (14)

## **Harley Street Hospital**

- Unknown Staff
  - Attempt to arrange temporary nursing home placement for Mr. Morales but are rebuffed. (15)
  - Arrange home assistance with Mr. Morales' family members. (16)
  - Arrange home assistance for Mr. Morales with local home health agency. (17)
  - Arrange home assistance with a community elderly assistance program. (18)
  - Discharge Mr. Morales with full information on home assistance support they have arranged. (19)

## **Dr. Prima's Office**

- Dr. Prima
  - Dr. Prima assures Mr. Morales' family that Mr. Morales will be monitored closely given their concerns about the internal bleeding. (20)
  - Dr. Prima provides educational materials, in English and Spanish, to Mr. Morales' family members who are assisting in his acute recovery. (21)

## **Mapping of PCMH Attributes to Health IT Use Cases**

The Federal government and the health information technology industry have done considerable work to standardize the information flows between information systems.<sup>19,20,21,22,23,24,25</sup> Still unanswered, however, is the question of whether all information flows and attributes of the PCMH are covered by these efforts. We used selected components of our information framework to map currently recognized interoperability specifications from the Health Information Technology Standards Panel (HITSP). The HITSP interoperability specifications lay out how to standardize the information flows that are part of the use cases developed by the American Health Information Community (AHIC). This public-private community established the use cases to promote breakthroughs in health care interoperability. The use cases and the subsequent interoperability specifications provided a good set of defined interaction flows for testing our information framework.

The latest version of HITSP-approved interoperability specifications was reviewed for coverage across the attributes of the PCMH. The interoperability specifications were reviewed instead of the AHIC use cases because interoperability specifications were designed to be implemented by health IT applications. An interoperability specification may also restrict the scope of its corresponding AHIC use case if it is not feasible to create a detailed interoperability specification for that portion of the use case.

The scope of the interoperability specifications is the exchange of information among organizations and systems. The interoperability specifications do not address interactions in the PCMH that are within an organization, or interactions between two individuals. This does not mean, however, that a specification or relevant parts of it could not be used to support interactions within an organization or between individuals.

The criterion for mapping to an attribute was that the interoperability specification directly supported the attribute. For example, the specification for EHR laboratory results reporting does not require that a result be sent to a specific practice. Although the interoperability specification could be said to support the attribute of “coordination/integration of care” (since the result could be sent to multiple practices, such as the PCMH and a subspecialist), this is not explicitly supported by the specification and thus, that specific PCMH attribute would not be mapped to the specification of EHR laboratory results reporting. We present below the definition of each HITSP interoperability specification, its mapping to the PCMH attributes, and a brief statement of issues regarding the level of completeness for those attributes within the use case or interoperability specification. Appendix C provides the matrix for the mapping of the interoperability specifications to the attributes identified in our framework.

## **IS 01 – EHR Laboratory Results Reporting**

The specification for EHR laboratory results reporting focuses on transmission of (1) complete, preliminary, final, and updated laboratory results to the EHR system (local or remote) of the ordering clinician and (2) complete, preliminary, final, and updated laboratory results (or notification of laboratory results) to the EHR system (local or remote) or other clinical data system of designated providers of care (with respect to a specific patient).<sup>26</sup>

This specification is focused on delivering laboratory results to an EHR system, which could be a PCMH. It provides guidance on delivering discrete data and documents.

The PCMH attributes mapped to this specification are:

- Integrated ancillary services
- Electronic medical record
- Electronic orders and results management
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge

The main focus of this specification is the “electronic orders and results management” attribute. A limitation is that the specification does not include the submission of an electronic order to the laboratory. Capturing the order and linking it to a result is an important functionality to support results management in a PCMH.

## **IS 02 – Biosurveillance**

The specification for biosurveillance focuses on a set of constrained standards for implementation of near-real-time, nationwide public health event monitoring to support early detection, situational awareness, and rapid response management across care delivery, public health, and other authorized government agencies. It prescribes the process or interaction that each primary stakeholder will invoke to capture, discover, anonymize, and transmit relevant data.

This specification deals with supporting event reporting to public health entities.

The PCMH attributes mapped to this specification are:

- Population management
- Community-based resources
- Regulatory compliance
- Electronic medical record
- Electronic orders and results management
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge

The “electronic orders and results management” attribute pertains to the submission of results to public health entities. There is no specification for the submission of orders or any results delivery to the PCMH. The “regulatory compliance” attribute is supported by the ability to submit mandatory case reports to public health entities.

## **IS 03 – Consumer Empowerment and Access to Clinical Information via Networks**

The specification for consumer empowerment and access to clinical information via networks identifies a subset of the functional components of health care enterprises and health information networks, called “HITSP actors,” and specifies their interactions in terms of a set of



coordinated, standards-based transactions. This document defines specific implementations of established standards intended to achieve integration goals that promote appropriate exchange of a consumer's personal health record (PHR) information.

This specification deals with the exchange of registration and patient summary data between the patient and the practice. The patient can provide basic registration data to the practice, and the practice provides an updated registration dataset and patient clinical summary.

The PCMH attributes mapped to this specification are:

- Supports care transition
- Patient participation
- Electronic medical record
- Patient portal
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Engage patient in health care process

Regarding the “patient portal” attribute, the specification is agnostic regarding the type of technology the patient uses, such as a patient portal or a PHR.

## **IS 04 – Emergency Responder EHR**

The specification for emergency responder EHR focuses on the use of standardized, widely available, and secure solutions for accessing and exchanging current and patient-specific historical health information during emergency response situations.

This specification deals with data collection by first responders and communication of data to health care entities (e.g., emergency department) and community resources (e.g., the National Highway Traffic Safety Administration).

The PCMH attributes mapped to this specification are:

- Supports care transition
- Structured, codified data capture

- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge

This is a highly focused interoperability specification. The interoperability between first responders and the PCMH will be limited. The specification does not focus on data moving from the PCMH to the first responder, which would have a higher utility for the PCMH and patient care.

## **IS 05 – Consumer Empowerment and Access to Clinical Information via Media**

The specification for consumer empowerment and access to clinical information via media addresses the recording of an individual's health information on portable media such as a CD or a USB key to achieve portability between the consumer's PHR system and other information systems. This document defines specific implementations of established standards intended to achieve integration goals that promote appropriate exchange of a consumer's PHR information. This specification addresses several key areas of the PHR: the patient's registration data and a health care summary that includes medication history, allergies, encounters, problems and conditions, immunizations, and key laboratory tests results.

This specification has the same use case as IS 03 (consumer empowerment and access to clinical information via networks), except that the transfer of the information is via electronic media instead of via the network.

The mapping and discussion is the same as IS 03 (consumer empowerment and access to clinical information via networks) above.

The PCMH attributes mapped to this specification are:

- Supports care transition
- Patient participation
- Electronic medical record
- Patient portal
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources

- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Engage patient in health care process

Regarding the “patient portal” attribute, the specification is agnostic regarding the type of technology the patient uses, such as a patient portal or a PHR.

## **IS 06 – Quality**

The specification for quality is designed to provide a set of standards and workflows to enable interoperable, electronic quality (e-quality) monitoring. The specification provides selected standards for encoding the data types required for encoding an electronic quality measure.

This specification deals with the submission of quality measure data and reports.

The PCMH attributes mapped to this specification are:

- Clinical outcomes analysis
- Quality improvement
- Quality and safety
- Structured, codified data capture

This specification deals with the submission of quality measures and does not deal with other aspects of the quality improvement process.

## **IS 07 – Medication Management**

The specification for medication management describes the information flows, issues, and system capabilities that apply to the multiple organizations participating in medication management. It is intended to facilitate access to necessary medication and allergy information for consumers, clinicians, pharmacists, health insurance agencies, inpatient and ambulatory care, etc.

This specification deals with the reconciliation of medication lists from multiple sources.

The PCMH attributes mapped to this specification are:

- Medication management
- Regulatory compliance
- E-prescribing

- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Coordination/integration of care
- Quality and safety

The “regulatory compliance” attribute is limited within the specification to required medication reconciliation by a regulatory body such as The Joint Commission.

## **IS 08 – Personalized Health Care**

The specification for personalized health care focuses on the exchange of clinically useful genetic/genomic test information, personal and family health history, and the use of analytical tools in EHRs to support clinical decision-making.

This specification provides guidance on the capture and transmission of family history and genetic testing results.

The PCMH attributes mapped to this specification are:

- Accessible patient health information
- Prevention screening
- Supports care transitions
- Electronic medical record
- Electronic orders and results management
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Integrate family and community information

As with the other specifications dealing with “electronic orders and results management,” there is some guidance on the transmission of orders for tests. The “prevention screening” attribute is limited within the specification to family risk factors and genetic testing. For the “integrate family and community information” attribute, the specification deals only with family information.

## **IS 09 – Consultations and Transfers of Care**

The specification for consultation and transfers of care focuses on the electronic exchange of information to support consultations between requesting clinicians and consulting clinicians, including specialty services and second opinions. This specification also focuses on the exchange of clinical information needed during transfers of care.

This specification deals with the request for consultation, the sharing of patient data to support the consultation, and the transmission of the summary of the consultation back to the requesting provider.

The PCMH attributes mapped to this specification are:

- Supports care transition
- Provider-to-provider communication
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Coordination/integration of care
- Language, cost, and needs appropriate

This specification provides a basis for PCMH-to-subspecialty interactions. The scenario provides guidance on how to include the patient’s preferred language in the consultation request; that is the sole reason for the mapping to “language, cost, and needs appropriate.”

## **IS 10 – Immunizations and Response Management**

The specification for immunizations and response management focuses on (1) providing information about individuals who need to receive specific vaccines, drugs, or other interventions; (2) the ability to report, track, and manage administration of vaccines, drugs, isolation, and quarantine; (3) the ability to identify and electronically exchange information

describing the treatment or prophylaxis status of populations; and (4) the ability to exchange specific resource and supply chain data from public and private sectors.

This specification deals with vaccine administration and reporting. The functionality for vaccine inventory reporting in the AHIC use case is not part of this specification.

The PCMH attributes mapped to this specification are:

- Community-based resources
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge

The specification provides guidance for the exchange of immunization records with registries, such as state registries, which supports the “community-based resources” attribute.

## **IS 11 – Public Health Case Reporting**

The specification for public health case reporting supports the bidirectional information exchanges of the public health case reporting process. It focuses on enabling more efficient data capture at the point of care, while allowing for optimization of the information delivery format and content, and finalization of current standards development organization (SDO) efforts. In the absence of standards in structured content and an associated clinical decision support for alerts and information reporting criteria, this specification provides options for the secure communication of basic presentation preserving content to better automate paper-based information flows.

This specification deals with case reporting from an EHR to public health entities.

The PCMH attributes mapped to this specification are:

- Community-based resources
- Regulatory compliance
- Electronic medical record
- Secure messaging

- Structured, codified data capture
- Quality and safety

The “quality and safety attribute” is mapped because the case reporting includes adverse event reporting.

## **IS 12 – Patient-Provider Secure Messaging**

The specification for patient-provider secure messaging describes the information flows, issues, and system capabilities that apply to patients and providers and that are required for patients to interact with their health care clinicians remotely, using common computer technologies readily available in homes and other settings.

This specification deals with secure messaging between providers and patients. It includes messages initiated either by the provider or by the patient.

The PCMH attributes mapped to this specification are:

- Secure messaging
- Patient portal

Either a PHR or a patient portal can be used in this specification.

## **IS 77 – Remote Monitoring**

The specification for remote monitoring addresses the data and information exchange requirements for the transfer of remote monitoring information from a device that is physically attached to or used by a patient in a location that is remote to the clinician.

This specification deals with the ability to capture patient data, such as glucose monitoring data or exercise diary data, from devices outside the practice.

The PCMH attributes mapped to this specification are:

- Self-care
- Wellness promotion
- Chronic disease management
- Automated technologies
- Structured, codified data capture
- Integration of information from diverse sources

- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Engage patient in health care process
- Goal setting and self-care

The specification does not provide guidance on wellness promotion or chronic disease management, but rather on how remote monitoring can be used to support such work.

## **IS 91 – Maternal and Child Health**

The specification for maternal and child health addresses the ability to exchange obstetric and pediatric patient information between EHRs; the ability to incorporate pediatric assessment tools, guidelines, and assessment schedules into EHRs; and the ability to exchange standardized patient assessments for antenatal care, prenatal care, labor and delivery, and postpartum care between EHRs. It also addresses the ability to incorporate assessment tools, guidelines, and assessment schedules into EHRs for antenatal care, prenatal care, labor and delivery, and postpartum care, as well as the ability to exchange this information with appropriate public health programs.

This specification supports the use case of exchanging maternal pregnancy information with the infant's pediatric record, and exchanging early pediatric information with the maternal record. An example of the latter is the recording of the infant's blood type (Rh status) in the mother's record, which is important information for future pregnancies.

The PCMH attributes mapped to this specification are:

- Prevention screening
- Integrated ancillary services
- Supports care transition
- Regulatory compliance
- Electronic medical record
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Coordination/integration of care



“Prevention screening” mapping pertains to both maternal antepartum testing and newborn screening. “Regulatory compliance” pertains to the exchange of mandatory newborn screening. The “integrated ancillary services” attribute is mapped because the data often consist of laboratory test results.

## **IS 92 – Newborn Screening**

The specification for newborn screening describes the information flows, issues, and system capabilities supporting newborn screening reporting and information exchanges among clinical care settings and public health.

This specification deals with the exchange of newborn screening data among providers, testing facilities, and public health entities. It also deals with the exchange of newborn screening data with patients via PHRs.

The PCMH attributes mapped to this specification are:

- Prevention screening
- Integrated ancillary services
- Community-based resources
- Supports care transition
- Regulatory compliance
- Electronic medical record
- Electronic orders and results management
- Population management registry
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Coordination/integration of care

Again, as mentioned in some of the earlier mapping discussions, the “electronic orders and results management” attribute within the specification does not specify electronic orders or transmission of them; it simply focuses on sharing and exchanging information.

## IS 98 – Medical Home

The specification for medical home focuses on the information received by the medical home for care coordination, and the manner in which this information supports individual patient needs and comorbidity management.

Although this specification is labeled medical home, it deals only with problem lists and practice-based patient registries.

The PCMH attributes mapped to this specification are:

- Clinical outcomes analysis
- Quality improvement
- Electronic medical record
- Population management registry
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge
- Personal physician
- Quality and safety

The “personal physician” attribute mapping reflects the requirement in the specification for how to designate the PCMH provider.

## IS 107 – EHR-Centric

The EHR-centric specification consolidates all information exchanges and standards that involve an EHR system among the 13 HITSP interoperability specifications in place as of the February 13, 2009 enactment of the American Recovery and Reinvestment Act (ARRA). This specification is organized as a set of HITSP capabilities, with each capability specifying a business service that an EHR system might address in one or more of the existing HITSP Interoperability Specifications (e.g., the Communicate Hospital Prescriptions Capability supports electronic prescribing for inpatient prescription orders). Greater detail on these capabilities is provided as part this interoperability specification, with the underlying HITSP constructs referenced in the Complete Library on HITSP.org.

This specification packages the other HITSP constructs into a single specification that addresses support for meaningful use.

The PCMH attributes mapped to this specification are:

- Accessible patient health information
- Integrated ancillary services
- Population management
- Supports care transition
- Provider-to-provider communication
- Patient participation
- Medication management
- Clinical outcomes analysis
- Quality improvement
- Regulatory compliance
- Electronic medical record
- Electronic orders and results management
- E-prescribing
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice based research, quality improvement, and generation of knowledge
- Coordination/integration of care
- Engage patient in health care process

## IS 158 – Clinical Research

The specification for clinical research covers clinical research in all its forms as it interoperates with health care systems, particularly EHRs. The specification spans two industries—health care and clinical research—and incorporates standards from health care (HL7 and IHE) and research (CDISC). The design leverages existing HITSP constructs and communication methodologies where applicable, and lays out new constructs as needed. The design also leverages current components of the clinical research industry such as electronic data capture systems and research registries.

This specification deals with the submission of clinical data to a clinical research entity.

The PCMH attributes mapped to this specification are:

- Regulatory compliance
- Structured, codified data capture
- Informatics infrastructure to support practice-based research, quality improvement, and generation of knowledge

The “regulatory compliance” attribute within the specification relates to addressing regulatory issues for practice-based research.

### Key Attributes not Covered in Any Interoperability Specification

The following attributes were not mapped to at least one interoperability specification:

- Open-access scheduling
- Flexible and expanded office hours
- 24/7 emergency access directly to physician
- Electronic visits
- Group visits
- Comprehensive care
- Patient education
- Task designation
- Clear roles and responsibilities
- Clear and consistent processes

- Effective communication
- Multidisciplinary team
- Evidence-based best practices
- Patient satisfaction feedback
- Risk management
- Financially responsible and successful practice
- Evidence-based decision support
- Practice Web site
- Confidentiality and security
- Cost-benefit decisionmaking
- Optimized office design
- Physician-directed medical practice
- Whole-person orientation
- Payment alignment
- Any provider can treat patient as “his or her own”

Regarding “confidentiality and security,” the specifications did address security of exchange, but such issues in a practice were out of scope.

Many of these attributes would not lend themselves to being described in an interoperability specification or use case. Some of the attributes, however, can be described in a health IT use case if the specification deals with intra-organization exchange. Examples include:

- Open-access scheduling
- Electronic visits
- Patient education
- Task designation
- Evidence-based best practices
- Patient-satisfaction feedback

## Conclusions From Mapping

This set of interoperability specifications has significant gaps related to support of the PCMH. This is not surprising, because the HITSP work was not designed to support the PCMH, although the use cases did focus on patient engagement and continuity of care. The information framework was a valuable tool to determine what aspects of the PCMH the specifications covered and what gaps remain.

## Implications

The creation of the illustrative scenarios and information flows demonstrates the high degree of information exchange required to support the PCMH. The interaction diagrams show how information must flow in and out of the PCMH to achieve many of the desired attributes of the PCMH model. This is in addition to the needed information flows within a PCMH practice.

### For Patients

The creation of a set of illustrative scenarios and information flows for the PCMH can provide a valuable tool to help educate the patient on what the PCMH can offer. The scenarios also could be used in facilitated discussions with patients to determine their wishes regarding PCMH implementation.

### For Providers

For clinicians within a PCMH, the model can provide examples of interactions and process flows that would demonstrate how the PCMH model is similar to or different from their practice in terms of delivery of care. A complete model could help the clinician think outside the traditional care delivery box, and thereby gain insight into how the PCMH could be implemented differently in his or her practice.

For clinicians in other settings who treat and interact with patients from a PCMH, this model will provide a better understanding of how a PCMH operates and encourage a willingness to coordinate care in a way that matches with the processes and practices of the PCMH. This awareness also may help these clinicians to better meet the expectations of patients from a PCMH, by putting a greater emphasis on accessible and coordinated care.

For clinicians who have little exposure to PCMHs and are interested in learning more about it, this model goes beyond a basic definition of a PCMH. This model provides a functional definition that covers the principles and attributes of a PCMH; the sites, subsites, and roles within a PCMH; and the flow of information within a PCMH and between a PCMH and others involved in a patient's care. The scenarios and the interaction diagrams provide a way to relate to real-life situations and the application of this model to such situations. The model also could be used to help clarify the intent of PCMH principles and attributes and to reduce confusion about what the PCMH is and is not.

## For Health IT Vendors

A PCMH information framework and model can provide a roadmap for a health IT system's development to support the PCMH. The model provides concrete descriptions of the information and process flows required to support the PCMH. The model and framework can also provide a roadmap for identifying the health IT use cases that need to be standardized.

## For Policymakers

A PCMH information framework can help articulate the scope of the PCMH and provide examples of experiences that make the PCMH concrete. The framework and model could be tools to help policymakers understand the exact definition of the PCMH in the context of statements about whether it works or doesn't work relative to quality and cost. This model can be a tool for policymakers trying to understand the principles and attributes of a PCMH as part of their efforts to evaluate the quality, efficiency, and cost-effectiveness of care provided under a PCMH-oriented approach to health care delivery.

## Future Work

### Current Gaps

As our literature review indicated, this effort was the first such effort to combine the principles and attributes of a PCMH with the associated sites, subsites, and roles to create a framework for identifying the flow of information. This high-level effort created the framework by assembling these components to allow examination and documentation of the interactions. However, it would be beneficial to work on examining each of the components in detail to explore their full scope and potential. For example, although there are many definitions and attributes of the PCMH in the literature and industry, there is a lack of explicit definitions of those attributes. This makes it very difficult to create an accurate and precise model. More work by the PCMH community is needed to define and clarify the attributes that constitute the PCMH. Defining the attributes will help in prioritizing them for consideration in future work aimed at further development of the PCMH information model.

The current model is incomplete for the purposes of establishing all standard specifications. It needs to be extended to support the entire PCMH, especially regarding process flows. The mapping of the attributes with the HITSP interoperability specifications needs to be reexamined after further refinement of the definitions of principles and attributes. Other specifications developed by HITSP can also be mapped with the attributes to review the extent to which they address the various elements of a PCMH. During development of the information framework, the expert advisory panel expressed ongoing concern about the possibility that creation of a single set of process flows could lead to ossification of the PCMH.

The current scenarios and interaction diagrams do not include datasets needed to support interactions because of the lack of consensus on the data needs of the PCMH. For interoperability and decision support, such data must be defined in both syntax and semantics.

Looking at the data elements identified in the HITSP interoperability specifications could assist in defining the needed data elements.

The attributes described in the literature lack clear and unambiguous definitions that are needed to refine the mapping work to health IT use case and interoperability specification efforts. By creating a standard set of attributes, the work can address the need to standardize interactions and process flows. The issue is not that everyone should use the same attributes, interactions, and process flows, but rather that there should be a master list from which individuals can choose to create a PCMH implementation. Such a master list would give health IT vendors a road map to support the PCMH and potential best practices for workflows that support the PCMH.

## **Alternative Interaction and Process Maps**

The PCMH continues to mature and evolve. It will be important to provide alternative interactions and process maps to demonstrate how it can be implemented and mapped to evolving standards and specifications.

## **Validation and Dissemination**

Strategic engagement of various stakeholder groups (patients, clinicians, standard-setting groups, and IT vendors) is essential in an effort to disseminate and validate this framework. A combined approach will achieve the goals of providing guided education and explanation of the framework to the groups (dissemination), and receiving feedback from the groups about the framework (validation)

Patient advocacy organizations need to be engaged to reach out to patients in explaining the framework and seeking feedback on how well it relates to their experiences with a PCMH. Similarly, clinical associations need to be engaged to reach out to clinicians in a variety of settings. Structured feedback loops need to be established for these groups to gauge their understanding of the framework and provide their insights into its relevance and application to their own experiences and expectations of a PCMH. Following such structured efforts to engage stakeholder groups, the consolidated feedback needs to be used to further refine this framework and its modeling using the scenarios.

Similar structured engagement of standard-setting entities and IT vendors involved in developing systems for PCMHs needs to be undertaken to examine the framework in the context of current standards and specifications, and to assess the implications for further development of the framework in ways that will be directly useful in system development.

Large-scale dissemination can be undertaken following the structured engagement of the stakeholder groups and further refinement of the framework. This large-scale dissemination can be undertaken by packaging the relevant parts of the framework for the appropriate groups of audiences, including patients, providers, policymakers, and health IT vendors. Several members of the project's expert advisory panel who represent patient and clinician associations and vendors have volunteered to help with dissemination of this framework.



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# Appendix A: List of PCMH Principles and Attributes

## **Access**

- Open access scheduling
- Flexible & expanded office hours
- 24/7 emergency access directly to physician
- Electronic visits
- Group visits

## **Coordinated care**

- Provider to provider communication
- Task designation
- Clear roles and responsibilities
- Clear and consistent processes
- Multidisciplinary team
- Effective communication

## **Continuity of care**

- Supports care transition
- Accessible patient health information

## **Community linkages**

- Community-based resources
- Integrate family and community information

## **Information system support**

- Automated technologies
- Electronic medical record
- Electronic orders and results management
- e-Prescribing
- Evidence-based decision support
- Population management registry
- Practice web site
- Patient portal
- Secure messaging
- Structured, codified data capture
- Integration of information from diverse sources
- Informatics infrastructure to support practice based research, quality improvement, and generation of knowledge
- Confidentiality and security

## **Payment**

- Payment alignment
- Accountability
- Structured payment to align with measurable improvements

## **Patient-centered care**

- Self-care
- Patient education
- Patient participation
- Engage patient in healthcare process
- Goal setting
- Language, cost, and needs appropriate

**Provider type**

- Personal physician
- Physician-directed medical practice

**Quality**

- Evidence-based best practices
- Medication management
- Patient satisfaction feedback
- Clinical outcomes analysis
- Quality improvement
- Risk management

**Scope of care**

- Comprehensive care
- Integrated ancillary services
- Whole-person orientation
- Any provider can treat patient as "his or her own"

**Active care management**

- Prevention screening
- Wellness promotion
- Chronic disease management
- Population management
- Cost-benefit decisionmaking

**Other**

- Regulatory compliance
- Financially responsible and successful practice
- Optimized office design

## Appendix B: PCMH Attributes X Scenario Matrix

To catalog the breadth and depth of the PCMH, a set of attributes was constructed as described in Appendix A. The set of attributes constitutes the “y” axis of the matrix. The names or identifiers of the scenarios constitute the “x” axis. When an attribute is used or “present” in a particular scenario, the intersection is marked. This makes it possible to quickly observe which attributes are incorporated into which scenarios and where there are gaps. This information will be useful later when use cases are mapped, to ensure that they represent all known attributes of the PCMH. The following four pages present the matrix of the nine scenarios and the complete list of attributes identified in this framework.

PCMH Attributes	Visit to PCMH			Visit to PCMH Referral to Specialist			Visit to PCMH Referral to Hospital		
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
	Childhood – Acute Illness	Adult – Acute Illness	Adult – Acute Illness	Childhood – Acute Illness	Adult – Prevention	Adult – Chronic Disease	Young Adult – Acute Illness	Senior – Chronic Disease	Senior – Acute Illness
	Kyle Wilson	Steven Joplin	Natalie Brown	Jennifer Davis	Amy Smith	Mr. Johnson	Mary Jones	Susan Miller	Robert Moore
Access									
Open access scheduling		1				1			
Flexible & expanded office hours	1								
24/7 emergency access directly to physician						1			1
Electronic visits		1							
Group visits									
Coordinated care									
Provider-to-provider communication				1	1		1	1	1
Task designation				1					
Clear roles and responsibilities				1					
Clear and consistent processes		1			1				
Multidisciplinary team					1	1		1	
Effective communication									
Continuity of care									
Supports care transition				1	1		1	1	1
Accessible patient health information		1					1	1	1

[illegible]





PCMH Attributes	Visit to PCMH			Visit to PCMH Referral to Specialist			Visit to PCMH Referral to Hospital		
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
	Childhood – Acute Illness	Adult – Acute Illness	Adult – Acute Illness	Childhood – Acute Illness	Adult – Prevention	Adult – Chronic Disease	Young Adult – Acute Illness	Senior – Chronic Disease	Senior – Acute Illness
	Kyle Wilson	Steven Joplin	Natalie Brown	Jennifer Davis	Amy Smith	Mr. Johnson	Mary Jones	Susan Miller	Robert Moore
Scope of care									
Comprehensive care									
Integrated ancillary services								1	
Whole-person orientation								1	
Any provider can treat patient as "his or her own"				1					
Active care management									
Prevention screening									
Wellness promotion									1
Chronic disease management		1			1				1
Population management									1
Cost-benefit decisionmaking									
Other									
Regulatory compliance									
Financially responsible and successful practice									
Optimized office design							1		
Total						1		1	

# Appendix C: PCMH Attributes X Interoperability Specification Matrix

PCMH Attributes	IS 01	IS 02	IS 03	IS 04	IS 05	IS 06	IS 07	IS 08	IS 09
	EHR Laboratory Results Reporting	Biosurveillance	Consumer Empowerment	Emergency Responder EHR	Consumer Empowerment and Access to Clinical	Quality	Medication Management	Personalized Healthcare	Consultations and Transfers of Care
Access									
Open access scheduling									
Flexible & expanded office hours									
24/7 emergency access directly to physician									
Electronic visits									
Group visits									
Coordinated care									
Provider to provider communication									1
Task designation									
Clear roles and responsibilities									
Clear and consistent processes									
Multidisciplinary team									
Effective communication									
Continuity of care									
Supports care transition			1	1	1				1
Accessible patient health information								1	
Community linkages									
Community-based resources		1							
Integrate family and community information								1	
Information system support									
Automated technologies									
Electronic medical record	1	1	1		1			1	
Electronic orders and results management	1	1						1	
e-Prescribing							1		
Evidence-based decision support									
Population management registry									
Practice web site									
Patient portal			1		1				
Secure messaging	1	1	1		1			1	1
Structured, codified data capture	1	1	1	1	1		1	1	1
Integration of information from diverse sources	1	1	1	1	1		1	1	1
Informatics infrastructure to support practice based research, quality improvement, and generation of knowledge	1	1	1	1	1		1	1	1
Confidentiality and security									
Payment									
Payment reform									
Accountability									
Structured payment to align with measurable improvements									
Patient-centered care									
Self-care									
Patient education									
Patient participation			1		1				
Engage patient in healthcare process			1		1				
Goal setting									
Language, cost, and needs appropriate									1
Provider type									
Personal physician									
Physician directed medical practice									
Quality									
Evidence-based best practices									
Medication management							1		
Patient satisfaction feedback									
Clinical outcomes analysis						1			
Quality improvement						1			
Risk management									
Scope of care									
Comprehensive care									
Integrated ancillary services	1								
Whole person orientation									
Any provider can treat patient as "their own"									
Active care management									
Prevention screening								1	
Wellness promotion									
Chronic disease management									
Population management		1							
Cost-benefit decision making									
Other									
Regulatory compliance		1					1		
Financially responsible and successful practice									
Optimized office design									
Total	7	9	9	4	9	2	6	9	7

PCMH Attributes	IS 10	IS 11	IS 12	IS 77	IS 91	IS 92	IS 98	IS 107	IS 158	Total
	Immunizations & Response Management	Public Health Case Reporting	Patient-Provider Secure Messaging	Remote Monitoring	Maternal and Child Health	Newborn Screening	Medical Home	EHR-Centric	Clinical Research	
Access										0
Open access scheduling										0
Flexible & expanded office hours										0
24/7 emergency access directly to physician										0
Electronic visits										0
Group visits										0
Coordinated care										0
Provider to provider communication								1		2
Task designation										0
Clear roles and responsibilities										0
Clear and consistent processes										0
Multidisciplinary team										0
Effective communication										0
Continuity of care										0
Supports care transition					1	1		1		7
Accessible patient health information								1		2
Community linkages										0
Community-based resources	1	1				1				4
Integrate family and community information										1
Information system support										0
Automated technologies				1						1
Electronic medical record		1			1	1	1	1	1	11
Electronic orders and results management						1		1		5
e-Prescribing								1		2
Evidence-based decision support										0
Population management registry						1	1			2
Practice web site										0
Patient portal			1							3
Secure messaging	1	1	1				1	1	1	12
Structured, codified data capture	1	1		1	1	1	1	1	1	16
Integration of information from diverse sources	1			1	1	1	1	1		14
Informatics infrastructure to support practice based research, quality improvement, and generation of knowledge	1			1	1	1	1	1	1	15
Confidentiality and security										0
Payment										0
Payment reform										0
Accountability										0
Structured payment to align with measurable improvements										0
Patient-centered care										0
Self-care				1						1
Patient education										0
Patient participation								1		3
Engage patient in healthcare process				1				1		4
Goal setting				1						1
Language, cost, and needs appropriate										1
Provider type										0
Personal physician							1			1
Physician directed medical practice										0
Quality										0
Evidence-based best practices										0
Medication management								1		2
Patient satisfaction feedback										0
Clinical outcomes analysis							1	1		3
Quality improvement							1	1		3
Risk management										0
Scope of care										0
Comprehensive care										0
Integrated ancillary services					1	1		1		4
Whole person orientation										0
Any provider can treat patient as "their own"										0
Active care management										0
Prevention screening					1	1				3
Wellness promotion				1						1
Chronic disease management				1						1
Population management					1	1		1		4
Cost-benefit decision making										0
Other										0
Regulatory compliance		1			1	1		1	1	7
Financially responsible and successful practice										0
Optimized office design										0
Total	5	5	2	9	9	12	9	18	5	